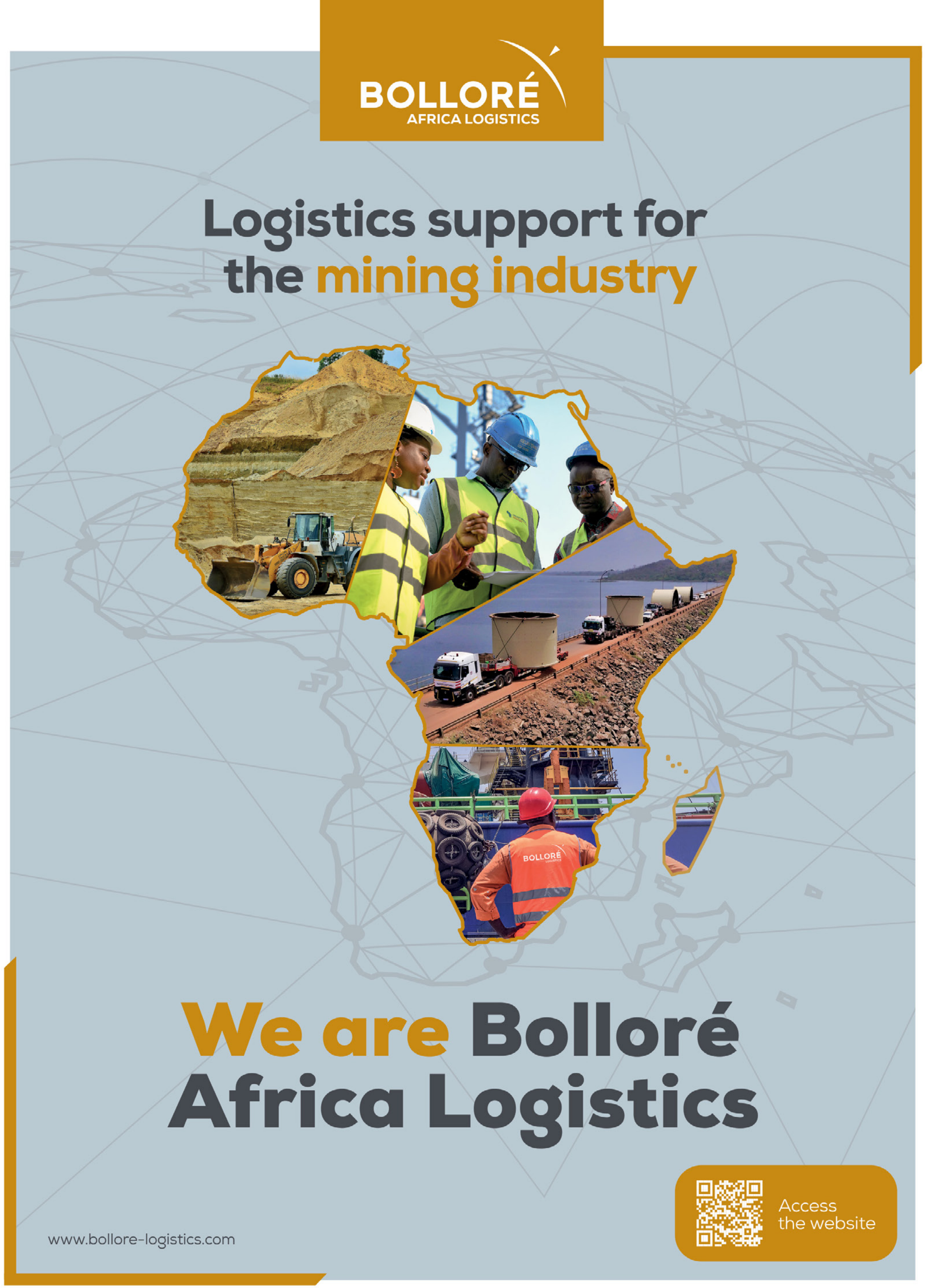
GLOBAL BUSINESS REPORTS

MACIG

MINING IN AFRICA
COUNTRY INVESTMENT GUIDE

2023



Dear Reader,

We are very pleased to present to you the 2023 MACIG edition, a book that, every year since 2014, has sought to honor its name as the "Mining in Africa Country Investment Guide" by providing its readers with the most complete overview of mining in the continent. We think we achieved this goal once again with this year's report.

Covering one of the most complex mining jurisdictions in the world – with at least 20 relevant countries, some of which are larger and more regionally diverse than many other nations in the world, and hosting almost every imaginable resource on earth – is never an easy task. This year, we interviewed over 130 executives in 28 African countries, of which 20 producers, 40 juniors, and about 50 service providers serving every part of the value chain (EPCs, labs, power, equipment, blasting, logistics, technology, legal, HR, and consultancies), as well as governments and financial institutions. And yet, as many explorers say in the industry about the untapped upside potential at their properties, we are still "only just scraping the surface." This 70,000-or-so word-report is still a summary of the incredibly vast and resourceful industry, but it is also the most comprehensive book dedicated to the mining industry in Africa, even after applying the rigors of the word "comprehensive," which cannot be used too freely.

To help our readers understand the dynamics specific to the continent, but also to different regions, countries, and communities, tied into global trends, MACIG 2023 is structured across four regions (West Africa, Southern Africa, Central Africa, and East Africa), and across seven commodity classes (precious metals, base metals, battery metals, graphite, rare earths, uranium, and coal). By mapping out the African mining industry in this way, we discovered a much broader mining universe that is taking root in unexpected places, like Uganda, Malawi, Sudan, Ethiopia, or Zimbabwe, as well as a vibrant new wave of developers looking at materials for every side of the electric battery, all of which can be found in the African soils. The first to understand the borderless opportunities that Africa's mineral belts have to offer are the junior explorers, who are expanding the continent's mining activity from north to south and from east to west, as well as tapping into a new basket of minerals – like lithium, rare earths, or graphite. But they are no longer alone. The world is starting to look at Africa differently, with less hesitation, and more wonder – as the solution to respond to a growing demand for critical resources and a key player on a world scene where Russia and China need not dominate.

We hope this year's report to be a useful platform to learn about the opportunities and challenges that Africa has to offer, but also to look back at 2022 and unpack its themes. And finally, we would like to thank our contributors, many of whom have participated in MACIG with every edition. We are humbled by the trust you bestow on us.

Alfonso Tejerina
Director and General Manager
Global Business Reports

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All interviews for the book were conducted between July and December, 2022

This research has been conducted by Lorena Postelnicu-Stancu, Germaine Aboud and Marta Armengod. Edited by Mungo Smith. Graphic Design by Kaori Asato

A Global Business Reports Publication

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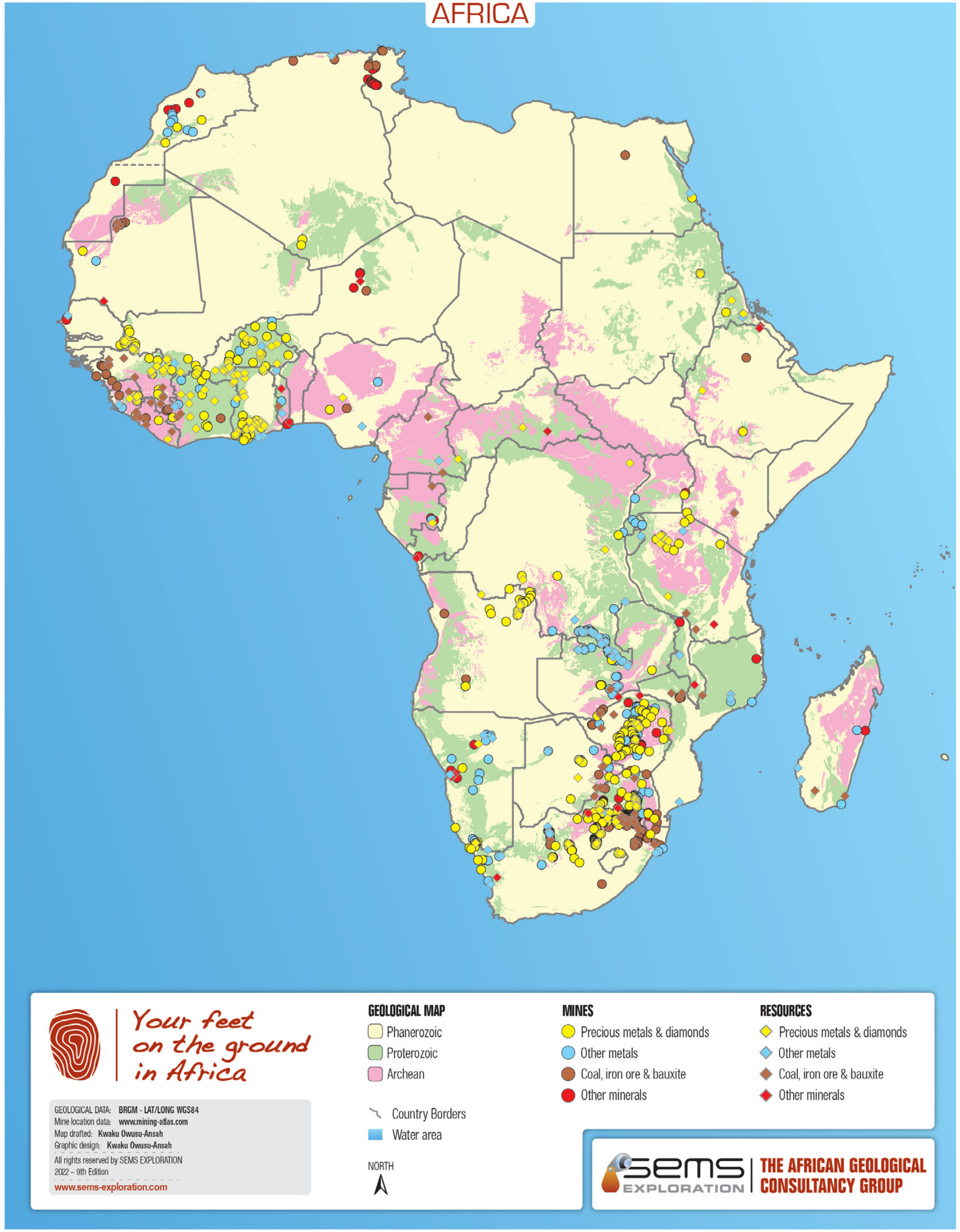


Introduction

> *"It is essential to move into emerging and underexplored mineral belts to maintain the discovery rate as part of a balanced development strategy. Our Africa & Middle East region is our most consistent producer of excellent performances on all fronts, as well as a rich store of gold and copper growth opportunities."*

-Mark Bristow,
President & CEO, Barrick Gold

Image courtesy of Antony Trivet.

Introduction

Inflation woes and African mining

I believe commodity prices will show resilience even as they retreated since last year. Mining companies sit on strong balance sheets, and many have a backlog of planned investments that will be rolled out in the next year.

Mike da Costa
CEO of Global Mining, Murray and Roberts (M&R)

The African mining sector never seemed to swim in the same waters as the rest of the global industry: It neither fully rides the high waves, nor flounders in a low tide such as we see today. Inflation hit differently in Africa, in terms of equity valuations, project CAPEX and OPEX, as well as the ability to raise finance. One might guess that African operators are experiencing worse inflation compared to their Canadian or Australian peers. Logistics can be tougher and therefore more expensive. A higher-risk jurisdiction can be penalized by banks and equity buyers.

But it must also be noted that African players have developed greater resilience against global shocks.

Regardless of what happened overseas, African miners and explorers have always had to deal with issues from within the continent, including security concerns, power blackouts, poor infrastructure, and unstable governance, in a mix specific to each country. While navigating these challenges, African players have developed projects with robust economics, leveraging on easy-to-find and easy-to-mine high grade and large tonnage deposits, as well as cheaper local procurement. Juniors have learned how to make investors look beyond the veil of jurisdictional uncertainty, while producers have become astute at operating mines profitably in some of the harshest environments, whether mining for diamonds at 3,000 meters altitude in Lesotho or developing some of the largest uranium mines in the deserts of Niger. These aspects have toughened the African industry, but not insulated it from the vicissitudes of upset global markets.

Inflation, caused by excess liquidity and a spike in energy prices, has been the main culprit of the current economic malaise. To stop the economy from overheating, the Fed increased interest rates sharply, causing markets to tumble – the S&P 500 contracted by 24% in the first nine months of 2022. Fears of a synchronized global recession have started to mount as real GDP growth is flattening out below 2% in both the US and Europe. Africa is expected to grow above the global average at 3.7% this year, but inflation, both imported and domestically instigated, is the highest in the world at 13.7%.

As the dollar strengthened to its highest level in two decades, reaching parity with the euro, investors rushed to the greenback, causing a contraction in metal prices, since most commodities are priced in US$. S&P GSC Industrial Metals is down by 19.9% year-to-date (YTD), while the benchmark for precious metals, S&P GSCI Precious Metals, is down 8.52% YTD. According to Reuters, nickel and palladium were the only metals whose price appreciated in 2022, while platinum, gold, silver, zinc, lead, copper, aluminum and tin lost value. At the opposite end, the prices of lithium, rare earths, and uranium have rallied in 2022. Coal also had a strong run and prices stay stubbornly high, defying predictions that its run will be short-lived.

Estimated to hold 30% of the earth's mineral resources, according to the World Atlas, the African mining industry is incredibly diverse, not lacking any of the important materials mined globally. Gold is mostly found in the Birimian Greenstone Belt in West Africa, the Atlas region of Morocco, and the Arabian-Nubian Shields of Egypt. Copper is mostly mined from the Copperbelt in the DRC and Zambia, but also in Limpopo, South Africa, a province also known for PGMs. Diamonds are famously found in Botswana, Angola, South Africa and Lesotho; while iron ore is in abundance in Guinea and the North Cape region of South Africa. Uranium is extracted in the Mersoï Basin in Niger and the Namib desert of Namibia, bauxite in Guinea, graphite in the Cabo Delgado region of Mozambique, and lithium projects have developed all around the DRC, Ghana, Zimbabwe, Mali and Namibia. Rare earth projects are emerging scattered across the continent. According to Africa Mining IQ, the continent counts 735 gold projects, 178 coal, 109 uranium, 150 diamond, 108 platinum, and 89 iron ore projects. Known best for gold, diamond and cobalt production, Africa is also beginning to assert itself in new economy elements, like lithium and REEs.

The volatility in commodity prices created a double blow for our clients in addition to cost flare-ups. However, inflationary pressures are also pushing our clients to be more selective in their reagent purchases and go for products that promise higher throughputs and an optimized beneficiation process, with less waste.

Justine Stubbs-Hult
Co-Founder and Group CEO, Axis House

Impact on OPEX

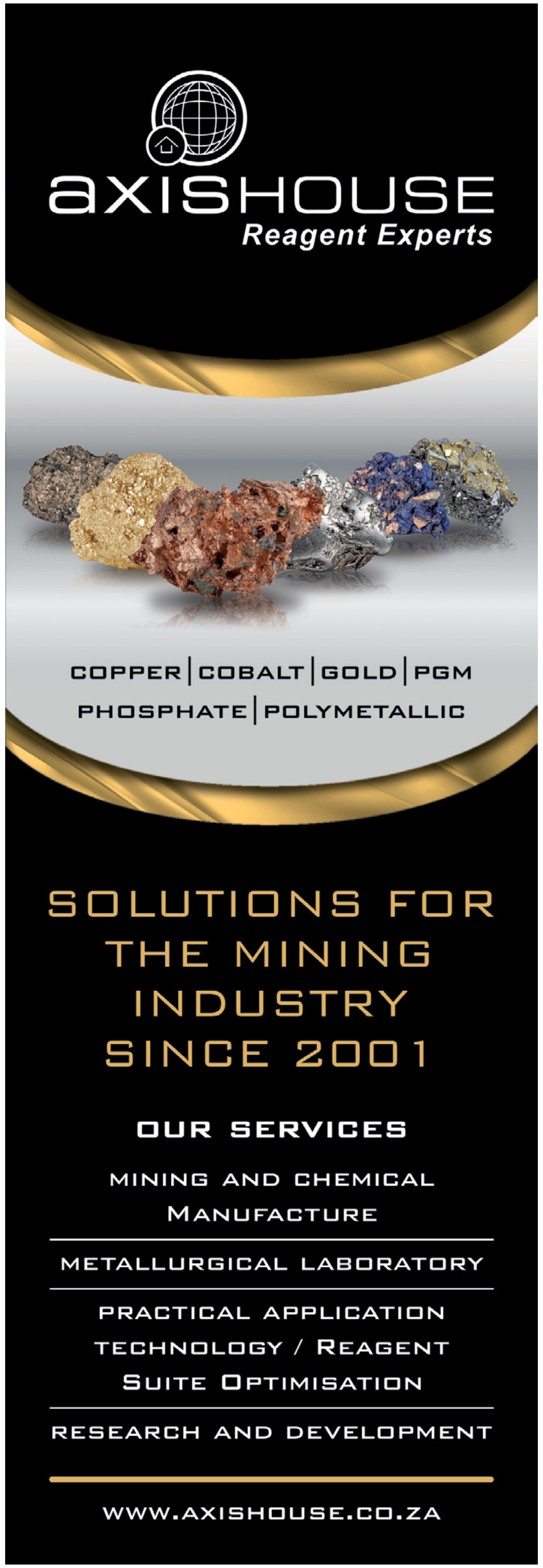
In an environment of heightened inflation, African miners and juniors still benefit from lower discovery and operating costs, with many expenses incurred in local currencies and most ore bodies found close to surface and amenable to cheaper mining methods. Weaker local currencies have also favored local suppliers, as imports in US$ became more expensive.

Energy, together with labor, reagents, logistics, and equipment are the biggest OPEX items for mining companies. Fuel represents circa 30% of costs for B2Gold, the mid-tier operating the Fekola gold mine in Mali. The company expects a 24% increase in the cost per ounce produced this year on account of inflationary pressures but also operational-related factors: "For FY 2022, we expect to be at the upper end of the original total consolidated cash operating cost guidance range and within its original total consolidated all-in sustaining cost guidance range," said B2Gold's president and CEO, Clive Johnson.

Each commodity, and probably each project, finds itself in its own unique OPEX climate. At a gold price at over US$1,600/oz, and average all-in-sustaining-costs (AISC) under US$1,000, the gold industry continues to enjoy a high margin that buffers inflated overheads. Diamond producers play in their own ring as demand for the hard gemstone weakened and expenses rose. By contrast, uranium producers are excited about a buoyant market.

A manageable OPEX is not only dependent on inflation inputs, but also on profitable outputs at the selling price. Trigon Metals, a Canadian junior operating in Namibia, brought the historical Kombat copper mine into early production in December 2021, preparing for commercial production this year. But as the price of copper lost much of the value accrued during the pandemic, Trigon was forced to pause mining: "The dramatic fluctuations in the copper price from US$4.5/lb to around US$3/lb put us in a money-losing position; moreover, recent drilling results showed there was an opportunity to find higher grade ore at surface that was not part of the original mine plan," said Jed Richardson, Trigon's CEO.

Trigon initially fast-tracked production to take advantage of the unusually high copper prices, but even at relatively high copper prices against a 10-years trend, inflationary pressures throw the operation into a negative margin. An adjustment is taking place, raising the bar on what makes "a high price." Higher operational expenses demand proportionally higher commodity prices to make projects viable. For instance, the uranium spot price, double what it was pre-pandemic, is still far from allowing new projects to come onstream, thinks Mur-



ray Hill, the CEO of Elevate Uranium, a junior developing the Koppies uranium project in Namibia: "Some developers used to say US$65/lb was the incentive price to start production, but the cost curve is higher now. The current price is not enough to cover costs for most projects, so the supply side will only respond to a higher uranium price."

Mining requires more careful algorithms to make operations profitable, but technology can help. Lotus Resources, a uranium company with an A$340 million market cap, bought the Kayelekera mine in Malawi in 2019. The mine had run between 2009 and 2014 at a cost of US$35/lb, which was higher than the selling price (which explains why its previous operators put the mine on care and maintenance). Even though the mine would be sustainable at current uranium prices, the new operators identified in the recent DFS four areas of cost improvement to make the asset sturdy under more hostile conditions. Lotus will start by converting the diesel gensets to a hybrid power system to reduce energy costs; then, by using nano filtration technology, Lotus will recover sulfuric acid from the back end of the circuit and feed it into the front end, reducing about 25% of acid consumption. Also, by applying sensor technology to sort out the high-grade material from the low-grade, Lotus plans to increase the feed grade; and finally, the company has a plan for reducing closure costs at the end of the mine life by using the main pit to store tailings after year six of production.

"Valuations can be sensitive in the current economic environment. The projections should also be limited to a reasonable time frame due to the variables affecting prices. CSA Global advises clients on how their projects can be developed while outlining the risk of exposure to commodity price fluctuations."

Sifiso Siwela
Africa Manager, CSA Global (an ERM Group Company)

Impact on CAPEX

Compared to OPEX, which affects existing operators and can be managed on an ongoing basis, the impact of inflation on CAPEX has been more vicious. CAPEX estimates have less flexibility to adapt to market volatility since they are time-sensitive for investment decisions on new projects. As one of the key indicators surveyed by investors in a PFS or DFS, CAPEX projections are subject to higher contingencies in a period of extraordinary cost fluctuations - building materials, diesel, and logistic costs went up alarmingly over the recent period. Some analysts believe inflation may have already peaked and is poised to normalize in the second half of 2023. Others are more pessimistic. What holds true for project developers today is that the projections made a year ago may not be as accurate today, while those made this year may be rigged in 12 months.

Capital expenditure for brownfield and greenfield projects has been revised upwards for most upcoming producers as energy, labor and equipment costs have snowballed. TSX-listed Fortuna Silver Mines had to review the construction budget for its Séguéla gold mine, now 80% completed, from US$145 at the beginning of 2021, to US$173 this year. Atlantic Lithium, the developer of the Ewoyaa lithium project in Ghana, published a revised CAPEX figure of US$125 million in its PFS this year, US$55 million more compared to the figure estimated in the scoping study done a year before. But the most vulnerable to higher CAPEX updates will be developers that have not yet secured financing for their projects. "There's no question that cost escalation will be testing project economics. Projects at pre-feasibility or definitive feasibility are more exposed to cost pressures. For these, inflation could influence the decision of investors and developers to move forward," said Peter De Leo, managing director of EPCM player, Lycopodium.

"Moving rapidly from a cash-consuming phase to a money-generating phase of the business is understandable, and, to some extent necessary, but this is a high-risk strategy."

Nick Tatalias
Managing Director, METC Engineering

Atlantic Lithium already has an agreement with Piedmont for US$70 million in exchange for 50% of the lithium spodumene from Ewoayaa, so the company has the flexibility to fund the remaining development with a combination of cash, debt, equity and offtake negotiations for the uncommitted lithium. The appetite for lithium financing is strong, and the higher capital costs are likely to be validated by financiers in a bull market that bodes better economics. The same is true of rare earths. Peak Rare Earths, the developer of the Ngualla rare earth project in Tanzania, updated its DFS this year to reflect the 14% capacity expansion together with other enhancements such as a shorter and lower-cost projected access road, the use of a lower-cost flotation collection, and the adoption of GITSM standards on the tailings storage facility. The company is targeting a final investment decision for the US$320 million CAPEX by May 2023. CEO Bardin Davis is confident: "While there has been some upwards movement in capital and operating costs, these have been more than offset by improved rare earth prices."

A less auspicious market surrounds gold projects. OreCorp, the developer of the Nyangaza gold project in Tanzania, published in August the DFS with an estimated CAPEX of US$474 million paid back in 3.7 years. Nyangaza is expected to produce 250,000 oz/y for the first decade. Speaking to GBR, executive chairman Matthew Yates said: "Initially, we were considering a 50:50 debt:equity financing structure, but our plan today is to maximise debt. We were looking to syndicate a group of banks to raise around US$300 million and received indicative debt funding proposals and non-binding expressions of interest for more than US$400 million."

Risk calculations

Both equity and debt financing have been tighter this year. Stunted metal prices and the flight of investors from commodity stocks have already created contractions in the share price of many African players. Even market favorites like the stock of Barrick Gold lost 16% this year, returning to pre-pandemic levels. Juniors had it much worse. The downwards trend, though rather corrective than regressive, tells speculators that returns already exploded in 2021. While weaker investment sentiment makes traditional equity financing more difficult, higher interest rates make commercial loans more expensive, but debt still remain a better alternative to issuing new equity and diluting stock at a low share value.

While falling prices keep CEOs awake at night across all time zones, companies with African assets have developed a thicker skin through constantly having to prove project excellence to make up for high jurisdictional risks. In an environment where private and public financiers judge projects more diligently, the industry's logic is to minimize the risks within their control. Juniors, particularly, are eager to start making cash and lower their dependence on external funding. Tantalex, a DRC explorer with a large lithium exploration permit called the Pegmatite Corridor, has found an opportunity in a lower-capital project with a short development timeframe: For US$10 million, Tantalex bought a small plant at TiTan; an alluvial tin and tantalum project that can be brought into commercial production in early 2023. For four years, TiTan will produce 1,400 t/d of tin concentrate and 22 t/d of tantalum concentrate.

Image courtesy of Golden Rim Resources.

Many other examples of juniors launching into shorter lead-time projects points to a widespread trend. In South Africa, Orion Minerals has diverted from its original development plan for the Prieska copper-zinc project: Rather than directly developing a 2.4 million t/y copper operation, Orion will start by mining the historic Crown pillar of the mine, which holds 1 million t of ore, to bring into production a small operation of 100,000 t/m. CEO Errol Smart commented: "As the markets changed, we saw a growing appetite to support lower-risk and lower-capital allocations with an early start. Even though investors have a high tolerance for mining risk, high-capital, long lead-time projects are a challenge. Instead, they seem prepared to live with slightly longer development timeframes for peak production."

This model is particularly favorable for gold projects, the strong price boding quick paybacks. In just nine months, TRX Gold, an explorer in Tanzania, managed to put an oxide plant into production. The costs were recouped in under three months. The Buckreef gold project, a JV with the State Mining Corporation of Tanzania (STAMICO), is a 2 million oz indicated + inferred gold resource graded at 1.8 g/t Au. TRX decided to start with the easy-to-mine 10% oxide resource, while it develops the remaining 90% sulfide deposit. The CIL oxide operation is producing about 1,000 oz/m at a very low AISC (US$500 and US$700 in the last two quarters) and can grow to 20,000 oz/m in the next couple of years.

This model of early production is advantageous because it lowers the initial CAPEX requirement, allowing developers to create an interim funding mechanism and advance exploration. Smaller, lower-risk projects, with a promise of high-returns, are probably best positioned to benefit from this strategy. High grades also help. Akobo Minerals, one of only two gold juniors in Ethiopia, made a small discovery with rarely seen average grades of 22.7 g/t Au in the resource estimate. The project, called Segele, is a petite resource containing 52,410 oz of inferred gold, and it will be brought into production in March 2023 with only US$10 million pre-production capital. The cash generated will fund exploration for a secondary, larger deposit called Joru.

For a junior operating in a country of little visibility for gold investors, starting a small-scale operation to self-fund was a necessary way forward. By contrast, for lithium developers, going into earlier production is a sign of business opportunism rather than necessity. Premier Africa Minerals, the developer of the Zulu lithium and tantalum project in Zimbabwe, suspended the work planned for the release of a DFS to focus on starting a sizeable pilot plant to produce 4,000 tons of spodumene a month. This was an opportunity not to be missed, said its CEO, George Roach: "It is important to note that the pilot plant compliments the DFS, we temporarily suspended work on the DFS, seeing the uptrend in Spodumene prices and the growing demand. This gives us a great opportunity to commence early production and repay the pilot plant in a timely manner."

However, this model is not suitable to all operations. Rushing into becoming a money-making rather than a money-eating organization can result in an ill-thought design and poor resource management at a later stage, warned Nick Tatalias, managing director of South African EPC company METC Engineering: "The worldwide sense of economic and political uncertainty engenders impatience, as companies want to make sure they capitalise on rising commodity prices now. Companies impatiently skip steps, jumping from scoping studies directly into DFS, or, from PFS directly into execution. Stage-skipping yields projects with unresolved issues and capital costs typically increasing, even blowing out, reducing investment in the mining sector because of a reputation of being poorly run." ■

Hadizatou Ousseini Yacouba

MINISTER OF MINES
NIGER

What have been the latest developments in the mining industry in Niger?
The government adopted the National Mining Policy document in 2020. Niger's mining code has also been revised to improve the sector's attractiveness. Currently, Niger is the home of one uranium mining company (SOMAIR), which marks the start of the exploitation works of the Dasa mine in November 2022, and two uranium mining projects at advanced stages: Madaouela, developed by GoviEx Uranium, and Imouraren, of Imouraren S.A. As of March 2021, COMINAK is closed, having entered a rehabilitation stage. Niger also has one industrial gold mine (SML). Since 1980, SONICHAR has been exploiting coal deposits in Tchirozérine in the Agadez region.

Security concerns are considered one of the biggest challenges of operating in the Sahel. How is Niger mitigating the situation?
The Country has made excellent progress in this area notably by strengthening international cooperation across the West Africa region, deploying military forces to secure borders, and by a structured and effective package of security assistance to mining and others mining sectors.

How is Niger positioned to respond to growing demand for uranium?
There are four uranium mining projects suspended due to the drop in the price of uranium. By 2035, Uranium production could increase from 3 200 tU to 4,200 tU and stabilize at more than 10,000 tU, raising Niger to the rank of 2nd world producer of uranium.

To date, Niger has several dozen uranium exploration permits in force and several perimeters are still free.

What is your vision for the mining industry in Niger?
Our priority is first to ensure the revival of the mining sector of our country and to make it play an important part in the growth of the country. This revival is essentially conditioned by the strengthening of existing structures the diversification of mining production and partners. Also, we have worked to improve governance, knowledge and promotion of the country's mining potential. ■

Lamine Seydou Traore

MINISTER OF MINES, ENERGY AND WATER
MALI

Can you share the recent developments in the Malian mining sector?
In 2021, Mali recorded 69 million t of gold. Nature has endowed Mali with plentiful resources, but this potential remains untapped. We have gold reserves of approximately 800 t. Besides gold, Mali has lithium, bauxite, diamond, iron and uranium.

Within the framework of mining diversification, we note the validation of the FS for the Mali Lithium Company and the Goulamina deposit, whose reserves are estimated at 31.2 million t with a grade of 1.56% Li2O and which would place our country among the world's largest producers of lithium.

Numerous initiatives are underway to organise and supervise the small-scale mining industry as part of a roadmap with the Chamber of Mines and the Mining Sector Governance Project through the implementation of two pilot projects in Kobada (southern Mali) and Loulo (western Mali).

New mines are expected to come on stream in 2022, including the new gold mine of Bagama Mining and the mine of Faboula Gold Sa. A few transactions are ongoing, including the transaction between Firefinch and the Chinese company Gangfeng for the development of the Goulamina lithium deposit.

Other developments include the promotion of hybrid energy sources to reduce production costs, while continuing to develop the recently discovered gas in Bourakèbougou.

We have also signed an MoU to create a gold refinery in the country.

What are your key priorities moving forward?
Mining resources are exhaustible and non-renewable, which is why we find it necessary to ensure that mining activity serves Mali today without compromising the lives of the future generations. In the new mining policy, the Ministry emphasized as key priorities the consolidation of the regulatory framework, the development of geological infrastructures and the preservation of the well-being of local populations. Besides, we must also ensure better governance in the sector, promoting local contractors, and protecting the environment pre, during, and post-mining. ■

Dean McPherson

HEAD OF GLOBAL MINING
TSX AND TSXV

"The ecosystem that we have built in Canada over the past 170 years is one that is significantly important for mining companies that are trying to get their stories not only seen but also correctly understood."

What makes Toronto Stock Exchange the preferred exchange for junior mining companies?

Over the past five years, 35% of equity financing for mining went through our marketplace, and 42% of equity financing occurred through our markets. The ability to raise capital is of paramount importance to junior mining companies. The other key consideration is our location. There is an element of stability that Canada provides from a financial, economic and regulatory standpoint when you consider the ability to endure global economic and geopolitical shocks. A final factor is the ecosystem that we have built in Canada over the past 170 years; it is one that is significantly important for mining companies that are trying to get their stories not only seen but also correctly understood. We have over 250 global analysts covering companies that are listed with us, in addition to the many bankers and technical professionals involved in and supporting our sector. We have a world class mining ecosystem built on the fact that Canada is a mining country.

To what extent do TSX and TSXV serve the needs of the full spectrum of mining companies?

What is great and different about our two-tier system is as companies grow and gain scale, they may choose to seamlessly move up or graduate to the senior market. Close to 50% of companies on the TSX started out on the TSXV, and approximately 20% of those companies that graduate have gone on to be included in the S&P/TSX Composite Index. Our innovative growth accelerator program helps our prospective and existing companies prepare for the changing demands of global investors and stakeholders, with teaching/coaching modules on ESG reporting; effective investor relations strategies; disclosure requirements; etc. We partner with our clients before they even get listed, preparing them to be a successful public company.

What regions of the world are you seeing capital flow into?

When you look at the significant demand for battery metals, you will find that the flow of capital is really following these commodities. As the fundamentals continue to support the significant demand for certain commodities, investors are willing to support projects in all jurisdictions, hedging any heightened jurisdictional risks by carefully considering other factors, particularly management teams with experience.

Can you speak to industry efforts to reward all stakeholders?

Any efforts to capitalize on the energy transition trend must be in the context of ESG/responsible mining and not leaving any stakeholders behind. Mining is ahead of most other sectors in modernizing its interaction with its stakeholders. That interaction has evolved beyond just pacifying stakeholders, while rewarding shareholders. The longevity of social licenses and the consequent lowering of operational/investment risks is optimized when the strategy is to partner with and reward all stakeholders. The world's eye is now so far reaching that this strategy has to be implemented for all groups at all corners of the globe.

How has the IPO market performed in 2022 on the TSX and TSX-V?

The global IPO market has been held back this year by macroeconomic factors, post pandemic and certainly geopolitical events. The mining sector, though resilient, has been impacted as well. Particularly in the second half of the year, the investor sentiment seemed to be predominantly to wait out the excessive volatility and uncertainty. New listings have been well short (down ~40%) of last year's outstanding performance. The fundamentals are still there, which is encouraging, and expectations are that decarbonization and other drivers are supporting a return to a robust IPO market once global economic issues correct themselves. As usual, timing is the big question. Our advice is that companies be prepared to execute on their IPO plans when the window of opportunity in the market opens. We have observed, in volatile times, these market opportunity windows can be short and so it pays to be ready to execute on an active and secure market like TSX or TSXV. ▪

Tom Attenborough

HEAD OF INTERNATIONAL BUSINESS DEVELOPMENT, PRIMARY MARKETS
LSE

What makes the London Stock Exchange (LSE) an attractive listing option for African miners?

Over a third of the companies listed on the LSE are from outside of the UK, making it the most international exchange globally, as well as Europe's largest market for raising equity capital. Both the Main Market and AIM offer companies access to deep pools of liquidity and a strong ecosystem of global investors and advisers.

While the mining companies listed on the LSE account for approximately 20% of the total market capitalisation of all listed mining firms worldwide, this includes companies across different stages of their growth, from multi-billion dollar majors to juniors with a market capitalisation sub US$100 million. Over the past few years, we have also increasingly seen listed mining companies choose London as an additional listing venue to boost their international profile, expand their investor base and increase liquidity. London is also a centre for African companies, with around 120 companies from the continent listed on the London Stock Exchange, together comprising a market capitalisation of over US$100 billion.

London also offers a strong ecosystem of support across the mining sector, with dedicated fund managers and focus from the research community. This has attracted a diverse range of mining companies to London, including those playing a key role in the transition to a low carbon economy. Over the last two years, we have seen a pick-up in activity from mining companies, with over a third of these listings focused on sectors that will play a vital role in the transition to a low carbon economy, such as critical minerals, battery metals and rare earths.

How has the London Stock Exchange performed in 2022?

So far in 2022, more than £13 billion in equity has been raised through IPOs and follow ons on the LSE. ▪

David Awram

COFOUNDER
SANDSTORM

Could you briefly introduce Sandstorm Gold Royalties to our audience?

Sandstorm is a royalty and streaming company that Nolan Watson and I started in 2008. In 2022, we acquired over US$1.1 billion worth of transactions, doubling the size of the company. Over the past year, we streamlined our portfolio, transforming those non-conforming assets into assets that are more like royalties and streams, which is what our investors want to see. As part of this strategy, in February we launched sibling company Horizon Copper, by deposing a 30% interest in the Hod Maden copper-gold project in Turkey through a reverse takeover transaction with Royalty North Partners. Sandstorm received a gold stream on the Hod Maden project with a 34% interest in the resulting issuer, Horizon Copper. From a functional perspective, both streams and royalties are effectively cutting the top line of revenue from the project, but the benefit of streams is that we can create these contracts ourselves and customize them, while royalties are purchased directly. Our most accretive transactions were those where we manufactured these precious metal streams and royalties on our own, which is what Horizon Copper does for us. Going forward, the bulk of our capital will be deployed into using a group like Horizon Copper to get higher returns and hit all those metrics that Sandstorm is famous for.

Do you have a final message?

We invite developers and juniors in every jurisdiction around the world, but especially in Africa, to work with companies like Sandstorm. We provide a good cost-to-capital product with very low risk. By joining early-stage companies, Sandstorm can bring a lot of validity to their project and provide a firm footing for project financing.

Over 15 years ago, my business partner and I predicted that stream and royalty finance will become a huge part of project finance because of the low-risk, long-term alignment that it provides. And I am happy to see we continue to be able to push a project forward no matter the commodity price cycle. ▪

ESG - Articles by Expert Contributors

SRK CONSULTING

Andrew van Zyl
Managing Director and Principal Consultant

Philippa Burmeister
Associate Partner and Principal Scientist

Tracey Drew
Senior Environmental Consultant and Team Lead for Innovation and Data Services

After the promises, there is more to define

Mining has taken its first ambitious steps toward a more sustainable future, setting many bold targets for itself. From now on, the sector must embrace both the practical complexities of the journey and the need to build consensus on what it all means.

There is considerable effort being invested in defining how various sustainability targets can be met and how these achievements are to be measured. In these relatively early days of responding to sustainability challenges there has been commendable commitment to doing things differently. To make concrete progress as a sector, however, we need a greater common understanding of terms like 'responsible' and 'sustainable'.

Seeking consensus

These definitions will differ according to context, but still need to be broadly accepted and measured in ways that everyone agrees are credible and constructive. Environmental, social and governance (ESG) metrics already face some criticism – for instance, for allowing some companies to score highly while still underperforming on certain priority areas. What is important, however, is that there is ongoing discussion towards finding consensus, and that growing levels of agreement will reinforce the integrity of sustainability reporting.

We are really still working out what we want to measure and how we can best do that. The next few years are likely to see more accepted definitions being adopted, and perhaps even certain organisations being identified as most effectively codifying industry aspirations.

As mines look for practical opportunities to decarbonise their operations, for example, there is considerable innovation underway that is intended to also drive ESG progress. Fine-tuning the sector's understanding of the targets and the way of measuring our advances will undoubtedly spur the evolution of relevant technologies.

Green taxonomy

An important contribution in the process so far is the European Union (EU) taxonomy for sustainable activities, also called the green taxonomy. This is a classification system established to clarify which investments are environmentally sustainable in the context of the European Green Deal. Covering objectives such as climate change mitigation and adaptation, the circular economy, pollution and biodiversity, the taxonomy aims to prevent greenwashing and to help investors make greener choices. To date, ESG has evolved in the absence of a common global rule book. Of course, this has not prevented technological advances – so we have to measure the success and potential of these innovations in the light of an evolving framework.

The use of more renewable sources of energy in mining operations has raised considerable interest in recent years, and technologies to reduce carbon intensity have been proven in their direct applications. The challenge is that it is still necessary in many cases to develop an adequate infrastructural ecosystem around these innovations.

Supply chain lag

From a supply chain point of view, there may still be significant transitional risk associated with these technical solutions. It will still take time to entrench these advances in a way that does not negatively affect the viability or bankability of projects. The suppliers, production at scale, maintenance skills, parts and dependable warranties for hardware technologies all still need to be created.

Conversely, software-based innovations, such as hyperspectral satellite monitoring and predictive climate change modelling, will be easier and quicker to roll out, and present considerable potential for monitoring and informing decision making.

Driving innovation for ESG

Innovation drives ESG progress and enables organisations to achieve their ESG goals. Without innovation, ESG would not have reached its current level of prominence. Consulting engineers have in fact promoted this integration in several ways – including sustainable design, the use of emerging technology, and the fostering of next-generation leaders.

In terms of sustainable design, many innovative ESG concepts – including societal and environmental impact studies, circular economy models and product differentiation—can be leveraged as part of the integrated design process for engineering projects. Similarly, new and emerging technologies are used by engineering firms to incorporate the value of sustainability innovation in their projects; among the advances are environmental management systems, void analysis tools and impact reporting software. Finally, this ESG-focused innovation needs to be sustainable across generations of professionals. Consulting engineering can foster a culture of creativity for each new generation of engineers to explore and grow. ■

ROBINSON INTERNATIONAL

Xavier (Jack) de Longueville
CEO

Harnessing Local Talents

The DRC is brimming with potential

For those who have never been in the Congo, here is an image that has always amazed me: On the side of the road at two or three in the morning, young Congolese are walking alongside old bikes filled with up to 100 kg charcoal made from wood. They will walk for maybe 30 km to reach the nearest city where they can sell the coal. Witnessing this made me sure that, if you want do get something done in the DRC, you can find hard-working and courageous people.

When I took over Robinson International in 2016 as a regional manager in the country, I fired our all-expats senior management team and replaced it with locals. I wanted to integrate the dedication and resourcefulness I saw in Congolese people into Robinson International, and we began implementing new strategies and policies to ensure that our workforce reflected the ethos of locals.

Robinson International is a British lab services firm that began operations in the country in 2005. We have laboratories all over the world, including a state-of-the-art facility in the DRC, where we offer inspection, sampling and analysis, including environmental analysis. Today, we have a fully local team of 100 people, except for me and our Indian finance director, who progressed from a very junior position. More than 50% of our lab technicians are women. We began implementing these changes before the DRC enacted the subcontracting law requiring multinational companies to hire a majority Congolese work staff.

Scraping off bad reputation

The bad reputation of the Congolese workforce is undeserved. It is true that the baseline for learning is lower due to improper education, but their extraordinary motivation and innovative spirit is unparalleled. Upon the end of colonial rule, the power vacuum and the subsequent secessionist movements hindered the country's democratic and economic institutions from maturing. The political and tribal infighting often led to the government ignoring pressing issues such as critical infrastructure, public health, and education, which can divert companies from investing in the DRC. But from my experience, the political and economic instability tends to overshadow the resilience and talent of the Congolese people. To give one example, one of our most valued employees, Selene, started off as a receptionist, but she had the initiative to ask for more responsibilities and decidedly progressed to become an assistant in the finance team, and then an assistant quality manager. She is now an ISO-accredited quality manager. She is constantly being offered jobs by different mining companies.

Local training and recruitment

If you take the time to train people, the results will be amazing. We implemented a training program whereby every staff member that joins the company goes on site to visit every position in the company, from cleaners to managers, to understand how their job affects those of others. This has created a very strong team culture.

We began to recruit students at local universities. Many of the students that we recruited for our lab tech positions are young women since there are now more and more female students entering STEM fields. We do not just ask young graduates to shadow people in the company as part of their traineeships, but we give them small assignments and teach them every single step of the job for up to a year. The returns are outstanding – in pure business terms, the returns far outstrip the investment; our attrition rate is low and costs are lower compared to hiring or relying on expats.

There will be challenges. The country is extremely poor. The learning curve in terms of technology adoption will be steeper, but also much faster. I noticed that the Congolese will "jump" technologies – skipping from rudimentary to advanced without passing through the intermediary phases. An illustrating example is the adoption of banking. Before 2005, there was no banking in the country, and the physical credit cards never caught on. Instead, people went straight to mobile banking. It was in the DRC and not in Europe when I first started using my phone to make payments.

When companies invest in fostering local talent and providing the right training and education to the community, they are helping not only their own companies, but also the development of the country. The DRC has grown so much that it accounts for 60% of our total revenues, while our team is incredibly sought-after, that they are often asked by foreign-managed companies to support them with technical assistance. My hope is to see them also train staff at other international branches - A Congolese professional showing the ropes to a foreigner would be the absolute reversal of the coin, after the Congo has heavily relied on expats for the high-skilled jobs. ■

How are equipment providers adapting to market volatility?

"We increased planned production in response to global market growth and a strong order book for 2022, but continual supply chain challenges have delayed invoicing leading to an increase in inventory and borrowings. Supply chain disruptions have ultimately prevented the completion of planned production and thwarted Bell from fully capitalising on the strong demand conditions. In South Africa we are used to consumption-driven inflation of 6 or 7%, but our major markets of Europe, the US and even Australia are not accustomed to the high inflation levels currently being experienced. We will be increasing our manufacturing footprint in the northern hemisphere in order to be closer to our suppliers and increase our manufacturing flexibility."

Leon Goosen, CEO, Bell Equipment

"Curiously, we did not experience significant issues when everyone else struggled with a poor state of supply chains. However, in the last four months, we have experienced significant shortages especially for electrification components like cables, circuit breakers, ECUs, and others. Mechanical parts have been less affected but lead times have been negatively impacted. This year, we delivered South Africa's first 32-ton underground electric dump trucks, currently being tested at mine sites. Together with the dump trucks, we also launched battery-powered LHDs. We designed these products with a compatible and interchangeable battery pack and other major components suitable for the LHDs and dump trucks. We have numerous R&D projects on the go, including a drill rig for open pit mining applications, autonomous LHD remotely controlled from surface and battery-powered LHDS and Dump Trucks, all underground mining applications."

Kevin Reynders, Managing Director, Rham Equipment

"Loesche inaugurated a new, first-of-its-kind sales department focused solely on digital solutions. What makes our digital solutions unique is the powerful interlink between them. Loesche South Africa is the only subsidiary in the world selling this package, which will be first applied at the Sephaku plant in Delmas. Other pilot operations are rolled out in Europe. The new digital department is our number one priority. We will kick-start with our first project at Sephaku Cement (known better as Dangote Cement) and we would like to grow our presence in the cement industry, before transitioning to the mining industry. In times of economic struggles, where costs are going through the roof, our technology is becoming critical as companies are forced to look for more efficient processes, with lower input costs, lower OPEX, and lower energy use. This is a good time for us to execute more projects."

Christian Gerhard, Managing Director, Loesche South Africa

"Our business does not step out from its essential role of offering hydraulic repairs on cylinders, motors, pumps, and all the and small machinery used by miners and contractors. This means that we do not necessarily grow on the back of ramped-up production at existing operations. However, the construction of new mines does create an opportunity for growth in the future. We have already strengthened our partnerships with key customers this year, and it is my goal to see this proliferating in the coming years. At the same time, the most important aspect for me is to make sure we look after our clients properly. African Mining Services is all about being there to service our clients. Our motto is to do the best we possibly can for our clients at any time, all the time."

Oliver Dallaway, Director, African Mining Services (AMS)

"We have seen significant demand for equipment in the past year. Mining companies require more support as they have been ramping up production, riding on the high commodity prices. Inflation has been consequential on all sectors of the economy, and equipment suppliers like us sit at the frontline of upward cost pressures for both equipment and spare parts. The additional and even more challenging layer to the cost problem is the limited availability of parts and components, due not only to logistics challenges – which have played a big part – but mostly to reduced production capacity struggling to keep up with post-Covid, pent-up demand. This situation has brought significant tension into the markets but thankfully there are some signs of improvement in the short and medium term."

Paul Maes, Sales Manager, Tractafric Mining

"Fraser Alexander was established in 1912 as a tailing's deposition service and evolved with the times. One of our core objectives is to grow our water treatment business. We see this as an opportunity to convert waste and reuse it for the benefit of the mine and the surrounding community. Secondly, we would also like to diversify into greener commodities; and thirdly, we are bringing in advanced technology to ensure safety and efficiency. For instance, we currently have a diesel-operated remote unit for hydro re-mining, but we have just developed an electric one to reduce carbon emissions. As a business, it is important to not only look at the financial benefits of today, but think about future generations and the environment they will live in."

Nompumelelo Makhoba, CFO, Fraser Alexander

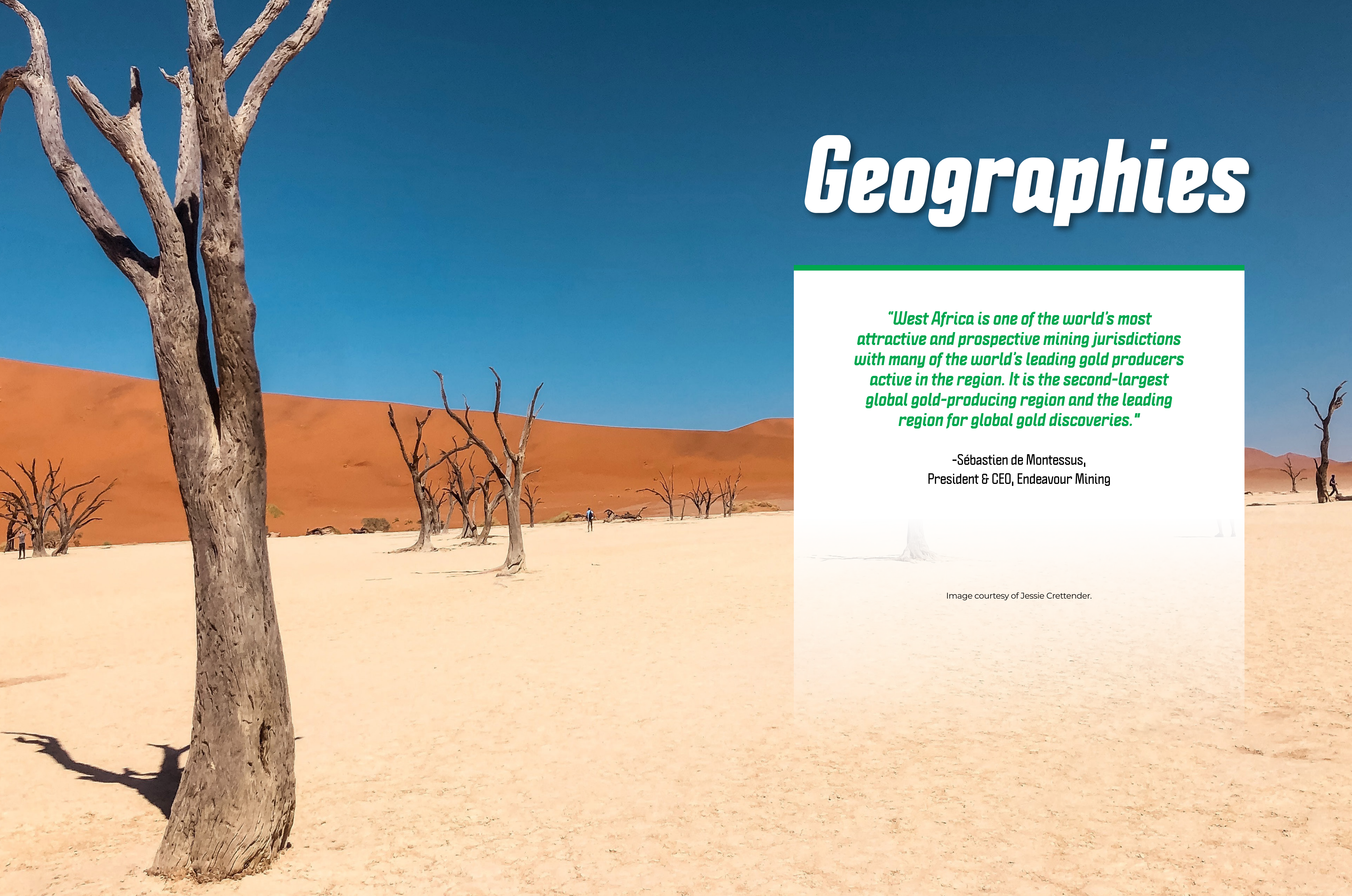
"Currently, 45 African mines either are planned to go underground or are already in the process of transitioning from surface to underground mines. As mines go deeper into the belly of the earth, temperatures on rock faces can be as high as 70 degrees Celsius. Under these conditions, ventilation alone using ambient air becomes desperately inadequate to provide a healthy working environment underground. We have seen a significant uptake of our Ventsim Engineering Services, as customers are increasingly trusting Howden as a provider of value-added ventilation and cooling services and technologies under one roof."

Kudzai Nyangoni, Managing Director, Howden

"HTDS (High Tech Detection Systems) has continued to provide services locally to mining companies. Over the past few years, we have seen many Chinese companies growing their ownership of Congolese assets. At first, it was challenging to adapt to a different culture and mindset, but we have now broken the ice and have been able to supply these companies with our equipment. Chinese companies usually prefer to import their equipment from China, but when they look for other quality and performances standards, they are open to alternative options like ours. HTDS remains the only local supplier in the analysis equipment space in the DRC, but another company is entering the market this year, creating, for the first time, direct competition. HTDS welcomes this development because we believe only by comparing ourselves with the competition we can differentiate ourselves and showcase our value-added services."

Derrick Kyaba, Country Director, HTDS (DRC)

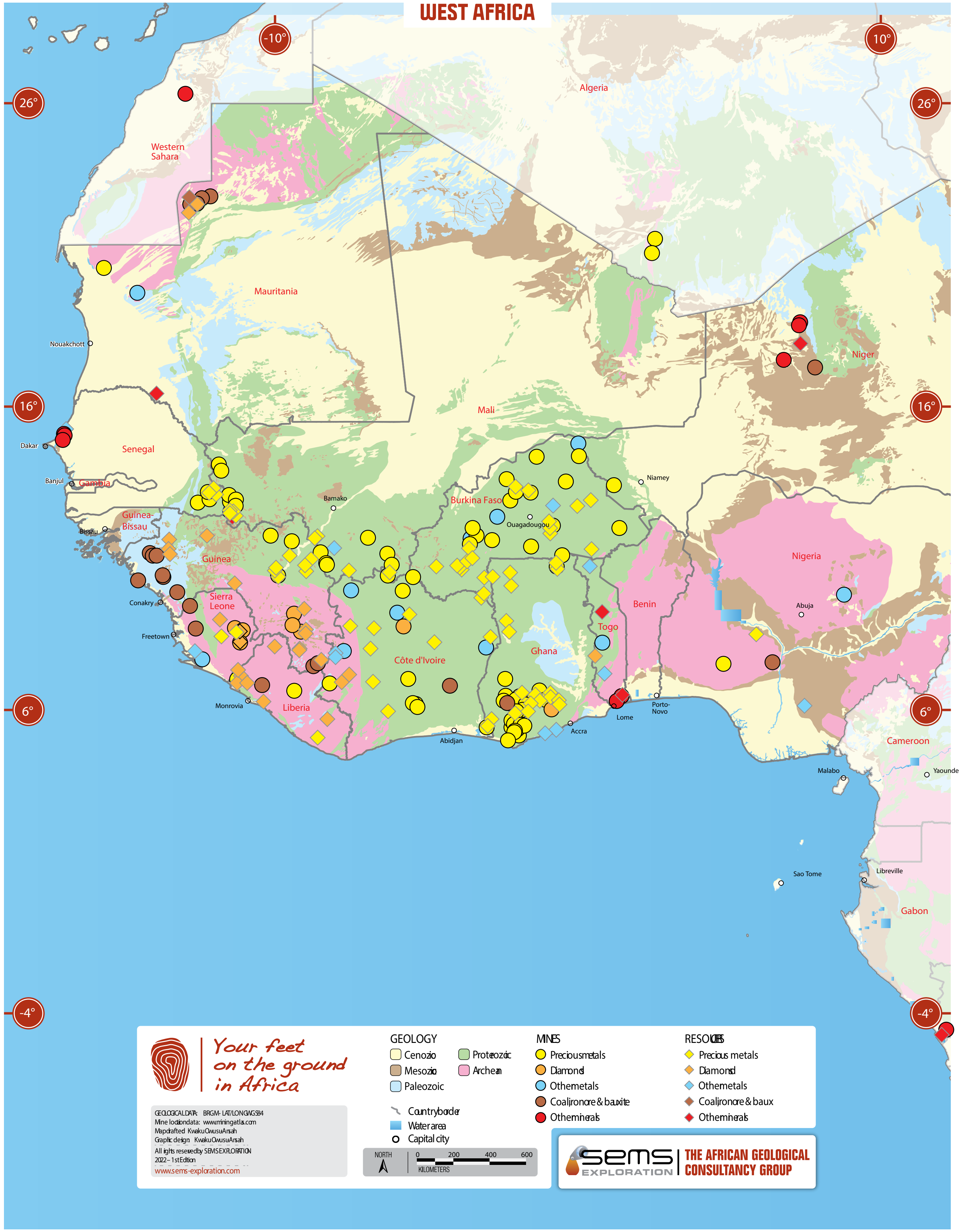
Geographies



"West Africa is one of the world's most attractive and prospective mining jurisdictions with many of the world's leading gold producers active in the region. It is the second-largest global gold-producing region and the leading region for global gold discoveries."

-Sébastien de Montessus,
President & CEO, Endeavour Mining

Image courtesy of Jessie Crettender.



West Africa

Highlighted projects

GUINEA

The Simandou North iron project

"We have been fortunate and nimble enough to secure a 490 km² exploration permit at the northern end of the Simandou Range, host to the largest undeveloped high-grade iron ore deposits in the world, on which Rio Tinto is developing the 2 billion tons Simandou project. The size and grades of the Simandou deposits make it the kind of world-class project that would normally fall in the hands of majors. Simandou North is a company-making asset and a game changer for Arrow. This is an early-stage play that will require significant work, but the area was explored previously, shedding light on the iron-hosting formations and lithologies running through it."

Hugh Bresser, Managing Director, Arrow Minerals

LIBERIA

The Dugbe gold project

"In my experience, it is often easier for a small junior to work on a single project, and this is what we have been doing with the Dugbe project in Liberia. Our chief geologist can never stop speaking about how wonderfully prospective this unexplored part of the Birimian is, as the geological structures continue to the east of us to those large mines in Ghana. 40 years ago, Ghana was in the same situation as Liberia today. Liberia has pulled itself out of the political mire that it was in 20 years ago, and it has become a pro-mining jurisdiction with very stringent regulations in place and clarity on what is required of us. The challenge is that people don't know Liberia and will ascribe unwarranted risk."

Daniel Limpitlaw, CEO, Pasofino Gold

NIGERIA

The Segilola gold mine

"Segilola mine poured first gold in December 2021, producing 6,000 oz for the first month. Our guidance for the full year is at 90,000-100,000 oz gold. Segilola is a high-grade deposit with low operational costs. For the first year of production, our AISC should average at US$850-950/oz, but we expect this to drop to US$700/oz average AISC throughout the LOM. Thor Explorations is fully leveraging its first-mover advantage in the country and we have a large land package around the current mine operation that we seek to fully study within a 30 km radius. The discovery of the deposit and turning this into a successful mine show that there is a lot of gold in Nigeria that is awaiting to be explored."

Segun Lawson, CEO, Thor Explorations

BURKINA FASO

The Cascades gold project

"The Cascades gold project had been held by other operators, but we amalgamated these holdings for the first time and also increased the land area from 60 km² to about 300 km². Previous operators had done about 65,000 m of RC and DD drilling, which we verified through a 4,000 m infill drill program in compliance with JORC requirements. Last year we published an initial mineral resource estimate of 264,000 oz of indicated gold at a 1.5 g/t Au and 371,000 oz of inferred at 1.65 g/t Au. Thanks to this historical data, our discovery cost for these ounces came at a phenomenally low rate of less than US$5/oz. Over the next few years, we will focus on drilling more targets – so far, we have only drilled two out of 23 targets and both were discoveries."

John McGloin, CEO, Diamond Fields Resources

MALI

The Kobada gold project

"Our main intention over the last year was to understand the opportunities outside of our main shear zone. We have 3.1 million oz total resource in our main shear zone, but this covers only 5 km out of what we think is a 55 km strike in our property. This year, we started auger drilling (AG). The AG has provided an enhanced regional exploration through which tested out the most prospective areas. On the back of this AG campaign, we had exceptional hits at our Kobada East concession, an area that warrants RC drilling follow-ups in the next 12 months. We awarded the contract to a drilling contractor to bring RC rigs at the end of 2022 for a 12-14,000m drill program."

Danny Callow, President and CEO, Toubani Resources

West Africa
Highlighted projects

IVORY COAST

The Koné gold project

"In February this year, we released the DFS for our Koné gold project in Ivory Coast. Based on a combined resource of about 4.5 million oz and a reserve of 3.4 million oz, Koné can produce over 200,000 oz/y for a LOM of 15 years. After the release of the DFS, we have also consolidated the landholding around Koné, by acquiring the Mankoko JV project from Barrick and Endeavour. This was a game changer, our tenure growing from 300 km2 to more than 2,000 km2. We also went back to exploration on the expanded holding, focusing on a small resource of 350,000 oz at over 2 g/t Au from one of the permits recently acquired."

Hugh Stuart, President, Montage Gold

CAMEROON

The Minim Martap bauxite project

"The BFS published in June 2022 revealed strong project fundamentals, with an estimated production of approximately 6 million t/y for 20 years LOM, which is a 28% increase from the PFS. Based on the BFS we are looking at US$253 million to build the project. The Minim Martap project is located very close to the existing railway line, but there is a need for improvement in order to run bigger and faster trains. Our current focus is to complete the signing of the Mining Conventions, which will deliver another major milestone for Canyon, and receive a full permit from the Government of Cameroon. Once we sign the Mining Convention, the next priorities are to negotiate with potential off-takers to sign commercial agreements and get the project funded so we can start construction in 2023."

Jean-Sébastien Boutet, CEO, Canyon Resources

GHANA

The Enchi gold project

"We delivered on all of the targets we set when we kick-started the 90,000 m drilling campaign: The first was to expand the mineralized footprint at our four known deposits (Sewum, Boin, Nyam and Kwakyekrom). Second, we went back to previously tested areas to advance those targets towards resource definition, and as a result of additional drilling we were able to define an initial mineral resource at Kwakyekrom. Third, we made three greenfield discoveries at previously undrilled targets: Sewum South, Tokosea, and a parallel structure at Sewum Extension. At this stage, we have only drilled nine out of the 25 targets identified at Enchi, which shows the district-scale opportunity. The final goal was to make high-grade discoveries by testing the upper limits of the sulphide mineralization. For the first time, we tested down to a depth of 300 m and identified multiple areas where we think we will be able to define underground resources."

Luke Alexander, President & CEO, Newcore Gold

GUINEA

The Kada gold project

"Kada sits on the Siguiri basin in eastern Guinea, a prolific gold area with little exploration compared to other parts of West Africa. Kada is an ex-Newmont project that we have been drilling for about one and a half years and put together a 930,000 oz Au maiden JORC resource of mostly oxide material. The 930,000 oz resource at Kada is really just the start because we only tested one out of 15 km from our target area. The resource is poised to grow a lot bigger in the next six months and we will be busy drilling for the rest of 2022. We hope to do a resource update early next year, and then start thinking about a scoping study. We believe Kada will be a mining operation, but we need to first identify how big it will be so we can scope it properly."

Craig Mackay, Managing Director, Golden Rim Resources

Image courtesy of GoviEx Uranium

West Africa

Redrawing the borders of a maturing jurisdiction

We can no longer talk exclusively about gold in West Africa, as other minerals like lithium or rare earths are claiming attention as an attractive addition to the traditional gold-focused portfolios.

Martin van Gemert
Regional Vice President (Africa), Mincon

If West Africa was a country, it would be the second-largest gold producer in the world, after China. As it stands, five countries in the region must share that title collectively, while another 10 countries benefit from the wider reputation of the region's geology as they individually seek the attention of investors. Geologically, there are no borders. The Birimian Greenstone Belt transverses the region without discriminating between the political and operational contexts of each nation, but investors cannot afford that freedom. Security challenges, political instability, and the lack of proper infrastructure have dictated the course of investments more than geology could.

The world's largest gold producers have been operating in Ghana for decades, while in the last 10 years, large mines were brought to life in Mali, Burkina Faso, and most recently, Guinea and Ivory Coast. The world's number one gold company, Newmont, is currently investing between US$750 and US$850 million in the Ahafo North gold project on the Sefwi Volcanic Belt in Ghana. Newmont is already operating the 643,000 oz/y Ahafo South mine since 2006, together with the 422,000 oz/y Akyem mine since 2013. Barrick, the second largest gold producer after Newmont, also operates two mines in West Africa; the Loulo-Gounkoto complex in Western Mali and the Tongon mine in Ivory Coast. Gold Fields, AngloGold, Endeavour, B2Gold, and Kinross are also here, while some mid-tiers and emerging mid-tiers were made in West Africa. Among these we name Perseus, Resolute, Orezone, West African Resources, Asante Gold and Tietto Minerals.

Along with these household names, new entrants have made their way to West Africa in recent years. Fortuna Silver Mines, a Toronto-listed mining company with a market capitalization exceeding C$1 billion, had three mines in operation in Argentina, Mexico and Peru, before acquiring its fourth one in Burkina Faso with the takeover of Roxgold. Today, Fortuna is primarily focused on completing the construction of its fifth mine, the Séguéla gold mine in Ivory Coast, entering production in 2023.

Jorge Ganoza, Fortuna's CEO, considers the region one of the most prolific in the world: "The combined size of Ghana, Burkina Faso, Ivory Coast, Mali and Guinea equate to the size of Texas, yet this comparatively small region of West Africa produces more gold than any but one of the top five gold producers in the world (China, Australia, Russia, the US, and Canada)."

The long-term presence of majors has been the most consequential factor in the maturation of the gold-rich jurisdictions, particularly Ghana, which has the longest history of mining, but also Burkina Faso and Mali, whose economies have strongly relied on the extractive industries in the past decade. This maturity, most evident in Ghana, is characterized by clear and stable mining regulations, solid relationships with governments and local stakeholders, a well-developed infrastructure and a robust services sector. In recent years, large corporations have also launched comprehensive ESG programs, common in tier-one jurisdictions. Just last year, Endeavour Mining, the region's biggest gold producer, rolled out the "Endeavour Foundation", running projects like "One village without malaria" in Burkina Faso, where the producer has its biggest footprint. "The countries we operate in have established and modern mining codes consistent with international principles. In addition, these countries have clear and swift permitting processes, which mean that the time from discovery to production can be as little as three years," said Sébastien de Montessus, Endeavour's CEO, defining his view of jurisdictional maturity.

The presence of majors has paved the way for juniors. A change is happening though: The countries that were most favorable for explorers 10 years ago are becoming more challenging, whereas jurisdictions that were no-goes in the past, are becoming more attractive. The reasons are multiple. Firstly, large companies control the exploration landscape of the most popular regions: Endeavour Mining holds a dominant land position across West Africa with 17,000 km2 of exploration land on the Houndé and Ity belts. The company wants to discover between 15 to 20 million oz Au by 2026 and has already drilled 250,000 m by mid-2022. Canadian senior miner B2Gold has also set aside a company record of US$75 million for its 2022 exploration budget. Most of these dollars were spent in Mali, where its flagship Fekola mine is located.

Dominated by majors and with little available exploration land left up for grabs, Ghana counts only a handful of juniors. Newcore Gold, a Canadian junior developing the Enchi gold project, is one of them. "Ghana is a well-established mining country with a long history of majors operating in-country, hence it is difficult for a junior to amass meaningful acreage. Newcore has been fortunate to hold our land package for over 10 years; it would be very difficult for a junior to pick-up such a large tenement today," said Luke Alexander, president & CEO at Newcore Gold.

The least explored gold structure in Ghana is the Kibi Gold Belt, a geological structure 10 times smaller than the Ashanti Gold Belt. XTra Gold Resources controls 70% of the belt and made a discovery with the same name (Kibi). James Longshore, the co-founder and CEO of Xtra Gold, said the belt had never been explored using modern tools before they acquired the property in 2003, possibly because most prospectors were focused on other belts next door: "Prolonged bear markets over the past three decades discouraged follow-up modern exploration; in the small windows of improved market sentiment when capital could be raised, explorers looked at other belts," said Longshore.

A well-established, competitive jurisdiction raises other entry barriers besides the lack of available virgin land. Exploration is more expensive both because all the low hanging fruits were found and because the fiscal environment can be more taxing. Longshore commented on Ghana's case: "With only nine large producers, the mining sector generates the largest source of foreign reserves for the government, who takes more than 50% of every net dollar. While this may be workable for producers during a boom period, juniors cannot afford the same level of taxation. Therefore, many Canadians and Australian explorers moved to Ivory Coast, Burkina Faso or Mali, choosing higher political risk over higher taxation."

The other driver that is reshufflings the focus of investors in the region is security. This has been most concerning in Burkina Faso, but Liam Morrissey, CEO of London-based risk intelligence MS Risk, said the war is expanding both geographically and in intensity: "We now see terrorist violence in the northern regions of Togo and Benin. Pressure remains in northern Ivory Coast, and it must also be building on the Ghanaian northern frontier, even if it is not yet visible."

Large swathes of West Africa have remained broadly underexplored due to instability, both political and military. While in the past, Guinea, Liberia, or Ivory Coast were almost inoperable, today the tables have turned and it is Mali and Burkina Faso where recent military coups and growing insurgent activity dishearten investors. Many juniors are leaving Burkina Faso for Ivorian and Guinean prospects, even though neither

"The Northern Corridor is the centrepiece of Lindian's long-term Bauxite development strategy in Guinea. Our goal is to build an infrastructure framework which connects the Company's Tier-1 bauxite projects with efficient transport logistics, comprising both in-country railway networks and shipping ports for export."

Asimwe Kabunga
Chairman, Lindian Resources

of these two countries are free of risks. For example, Australian explorer Golden Rim has put on hold its 2 million oz Kouri gold project in Burkina Faso, shifting its focus to a smaller gold discovery in Guinea. Once again, the presence of at least one producer in a newly opened country, such as AngloGold Ashanti in Guinea, is a critical advantage for juniors who can tap into already worked-out mining and exploration legal frameworks; it is also useful to show investors examples of large mines built and ran successfully by a respected major.

Neighboring the gold-rich Mali and Ivory Coast to the east, Guinea is better known for bauxite, as the world's biggest exporter, and iron ore, hosting what is believed to be the world's biggest untapped iron ore deposit, Simandou. The endlessly delayed Simandou project is an example of an almost missed African opportunity due to a mix of corruption and lack of infrastructure, but finally, a much-awaited agreement between Rio Tinto, the Winning Consortium Simandou (WCS), and the Guinean government has been reached to develop Simandou after multiple stand-offs. Under the newly created "La Compagnie du TransGuinéen," the consortium will build a strategic corridor of 600 km rail infrastructure, for the 4 billion million t resource. The investment is estimated to range between US$5 and US$10 billion.

As it happens, an investment of this scale is already catalyzing more opportunities in the country. Arrow Minerals, a junior with gold assets in Burkina Faso, has secured a 490 km^2 exploration permit at the northern end of the Simandou Range. "Five years ago, the lack of infrastructure made it impossible to come close to such a project. The infrastructure investments made by these groups are opening the country for development," said Hugh Bresser, managing director at Arrow Minerals.

Further south on the West African Coast, Cameroon also holds large reserves of gold, iron ore and bauxite, while promising better political stability compared to Guinea. But with a less developed mining sector, the infrastructure hurdle is commensurate. ASX-listed Canyon Resources is developing the Minim Martap bauxite project, which holds close to 1 billion tons of ore in the ground. The BFS recently published showed an estimated production of approximately 6 million t/y for 20 years LOM, which is a 28% increase from the PFS. The increase in the annual production rate is explained by the investments made by the Cameroonian Government and its partners to increase the capacity of the existing rail infrastructure within the country. Even so, close to 40% of the US$253 million CAPEX to build the project will go to logistics-related assets.

In their search for the next big hit, juniors are drawing geological parallels between their greenfield exploration targets and nearby or geologically linear existent mines: Newcore is drilling on the same gold belt of Newmont's prestigious Ahafo in Ghana; Golden Rim is validating its Kada deposit as an analog to the AngloGold's Siguiri mine on the Siguiri belt in Guinea. TSXV-listed Diamond Fields Resources, on the other hand, sees geological similarities between its gold deposit in Burkina Faso and the Yaouré mine across the border in Ivory Coast. Overwritten by geological potential, and underwritten by a workable operational environment, borders disappear, while individual mineral belts – Ahafo, Siguiri, Ity, Houndé, Yanfolila, Boromo, Bibiani, Mako, and others, which cross one or more countries, gain a reputation of their own. ■

Roger Staley

CEO

AAMEG (AUSTRALIA-AFRICA MINERALS AND ENERGY GROUP)

> *Overseas, Australian players realize we are a small band and need to look after each other and together promote "Brand Australia" as best practice in the resources sector.*

You took over as the new CEO of AAMEG at the beginning of 2022. What is your vision for AAMEG?

Rather than coming in with a ready agenda, I wanted to first find out why our members choose to join AAMEG. Based on a survey done at the end of 2021 and also various conversations, we found out that AAMEG is probably most relevant to junior explorers and mid-tiers. It is regrettable to see that some of the bigger organizations can reach a point where they think they no require the kind of advocacy, insights and connections that AAMEG provides. I am exploring how to expand our relationships, for instance through seminars, forums, and workshops with specialist subject matter experts who have walked the walk in Africa. Overseas, Australian players realize we are a small band and need to look after each other and together promote "Brand Australia" as best practice in the resources sector.

What have been the key developments that AAMEG has been involved in over the past year?

In the first six months of 2022, borders reopened and Australians are now traveling regularly to and from sites, but I hesitate to say we are back to business as usual. Recent instability in West Africa and East Africa has also been troublesome and rampant inflation in places like Ghana is impacting our members' cost controls. However, I think Australian companies operating in Africa are more equipped to deal with inflation compared to their Western peers. For instance, in the developed world, wage demands have escalated to the point of being unsustainable, especially for expats traveling to sites in an era of unreliable and expensive air travel.

What are the most pressing concerns that your members shared based on the survey?

The number one item of interest for our members is security; of people, operations, tenure, and so on. Closely tied to security is the issue of compliance. Our members tell us that ESG is third on their list of priorities but, rather than expect AAMEG to provide services on this matter, they expect us to be abreast of the issues.

We are providing a unique voice in two directions – from our members to the Australian government and other governments, and from the Australian government and other governments to our members.

How do you think the mining industry can navigate security concerns, and how is AAMEG supporting in this sense?

We have members on the ground in 36 African countries, with South Africa, Ghana and Tanzania being the top three destinations for Australians in the African resources sector. They advise us and we use that feed of information from our members and balance it against other sources to clear out false information. Moreover, we have a strong relationship with the Department of Foreign Affairs and Trade (DFAT) and the Australian High Commissions and Embassies throughout Africa.

In 2022 the new High Commissioner to Ghana reinstituted the West African Mining Security Conference at which AAMEG chaired several sessions. During the conference, we learned that a lot of the unrest is about exploiting fault lines – cultural, racial, economic, or otherwise. This leads us to believe that the best way to combat extremism is by providing employment and business opportunities to host communities. Mining development stands alone in its ability to generate economic opportunity in regions of high unemployment where extremism tends to flourish.

Mining has the potential to cut across those differences by reaching out to those people in remote areas that are targeted to join extremist quarters and that are ignored by the authorities, bullied, or without other options.

Can you comment on the role of the AAMEG Africa Awards?

Held during the African Down Under Conference, the AAMEG Africa Awards is our way to promote "Brand Australia" in mining, by shining a light on the good things Australian companies (not just AAMEG members) are doing in terms of ESG. This year, the case study that took everyone's breath was Vaka Health, founded by a Zimbabwean nurse based in Australia who implemented a cell phone based support and accreditation platform for midwives in Zimbabwe. Today, 95% of midwives and nurses in Zimbabwe have real-time access to this network of expertise that can save lives, and now the technology is being rolled out in other parts of Africa. ■

Ghana

Delicate fiscal and macroeconomic interventions

Main producers and upcoming producers: Newmont, Kinross, Gold Fields, AngloGold Ashanti, Perseus Mining, Resolute Mining, Asante Gold, Shandong Gold, Chifeng Jilong Gold

Main juniors: Newcore Gold, XTra Gold, Ibaera Capital, Atlantic Lithium

Image courtesy of Gold Fields.

Ghana has been setting the tone for the entire region when it comes to regulation. In the last year, the focus of the government has been to also improve compliance, both regulatory and tax. The introduction of a waiver on penalties for businesses that have defaulted has been extended to the end of 2022, giving companies the chance for a clean slate on their unpaid duties. Richard Ansong, partner at PwC Ghana, told GBR that the country is also evaluating a proposal to settle tax disputes outside of the court system, which would speed up such cases. Moreover, the country introduced a VAT penalty for unregistered importers, while the Ghanaian Revenue Authority has onboarded taxpayers to an electronic invoicing reporting regime (E-VAT).

These nuanced measures are a sign of regulatory sophistication and will have a light, though important, impact on the industry. More immediately felt was the enactment of a 3% withholding tax on artisanal miners, later revised to 1.5%. This new tax is thought to have played a big part in the reduction of Ghana's total gold output, which fell by almost 30% in 2021: "The main contributor to this drop is the reduction in official production output in the small-scale mining sector," said Ansong, quoting the 3% withholding tax as the main cause for the abrupt change.

By some estimates, gold mined by artisanal miners every year in Ghana is almost equal to that produced by registered gold miners, though the numbers are hard to verify. Officially, informal miners account for only 20% of total gold production. Kiki Gyan, regional managing director at testing and certification company SGS, thinks the real numbers are probably higher: "The lower production figure (recorded this year) is explained both by the government shutting down many illegal operations by depriving them of equipment, but also by the fact that a lot of artisanal activity has moved to the black market and is not captured in official reports," he said.

Lower mining outputs came at a bad time for the Ghanaian economy, which has been fighting a plunging currency (Cedi) and one of the highest inflation rates of the continent, at over 28%. Kofi Frempong-Kore, partner at KPMG Ghana, said all fiscal and economic targets were missed this year: "Inflationary pressures, like double the price of fuel, and food shortages are far from abating. The government is working around the clock to bring the economy back on track and boost national revenues while reining in public spending," he explained.

To avoid running a higher debt, the Ghanaian government reached out to the IMF for a US$3 billion bailout, which commentators see as a positive, proactive move, and most agree it has a strong chance to be approved.

Meanwhile, investments in the mining industry have mostly come from China. Last year, state-owned Shandong Gold completed the acquisition of Cardinal Resources and its Namdini gold project, while most recently, Shanghai-listed Chifeng Jilong Gold Mining acquired Golden Star Resources, the owner of the Wassa gold mine. Brownfield acquisitions were principally headed by Asante Gold, a Canadian explorer and developer that last year bought the Bibiani gold mine from Resolute Mining, and this year the Chirano gold mine from its former operator, Kinross. Asante's rise in the ranks of gold producers makes it the first mining company to be trading in Ghana, after the Toronto-listed player completed a secondary listing on the Ghana Stock Exchange.

Whereas brownfield projects have been changing hands not without vigor, the exploration sector has been less exciting. There are only three greenfield gold projects that GBR is aware of in the country; an underwhelming number for the largest gold producer in the continent. These are Newcore's Enchi gold project; Xtra Gold's Kibi gold project; and Ibaera's Black Volta gold project.

Newcore Gold has made significant progress following its recently completed drilling campaign at the Enchi gold project. For the first time, the explorer dug bellow 125 m vertical depth, making multiple high-grade sulfide discoveries: "At Nyam, we believe have been able to identify two high-grade shoots that plunge to depth with multiple intercepts of +5 g/t Au material between 150 m to 300 m below surface. As part of our updated resource estimate in Q4 2022, we hope to be able to define a small underground resource," said aid Luke Alexander, Newcore's president and CEO.

Underground exploration is unusual in West Africa, but gradually becoming more common in Ghana, where about half of the current mines are underground. The fact that one of the most advanced gold explorers in the country is considering underground opportunities is a natural sign of Ghana's geological maturity. The other one – and arguably more problematic for explorers – is its fiscal regime. The tax burden comes close to 55% of net proceeds, without discrimination between juniors without a cash flow and producers. "The problem is that the government treats mining and exploration in a very similar fashion. Every year, we hear pledges about tax cuts, but this has not happened yet. Instead, the government is more focused on lowering barriers for bauxite and lithium," said James Longshore, the CEO of Xtra Gold Resources, one of the main explorers in the country.

The government is indeed eager to see Ghana's first lithium mine onstream. The Ewoyaa lithium project developed by Atlantic Lithium currently holds 30.1 million t at 1.26% Li_2O total resources and should come into production in 2024. The success of Ewoyaa is likely to motivate further exploration of the Ghanaian pegmatite belts. ■

"The government is hopeful a deal can be reached with the IMF by the end of 2022. The central bank of Ghana has also begun an initiative to purchase 10,000 oz of gold annually from mining companies locally to shore up the country's reserves."

Richard Ansong
Partner, PwC Ghana

"The depreciation of the Cedi has made it more difficult to pay our suppliers in US$ and has shrunk our margins in the process. However, we managed to open the first sole lubricant terminal in Tarkwa, the first-of-its-kind in the country."

Peter Alexander Quarm
CEO, Dutylex

Ivory Coast

The buzz of new mines

Main producers and upcoming producers: Barrick Gold, Perseus Mining, Fortuna Silver Mines, Endeavour Mining, IAMGOLD, Centamin

Main juniors: Tietto Minerals, Mako Gold, Awale Resources, Montage Gold, Sama Resources

"Ivory Coast has always been seen as a potential gold producer, and things are really starting to happen for the country, with the advancement of multiple mines."

Bernard Kaninda
Regional Director Africa, Maxam

More mines are currently being built in Ivory Coast than anywhere else in West Africa. These investments lay the grounds for a positive outlook for the country, whose growing economy is growing at 6% this year, while the country remains stable and safe, despite some military pressures mounting at the northern border with Mali and Burkina Faso.

Barrick, one of the biggest gold producers in the country, is actively exploring near-mine permits to extend the life of its Tongon gold mine, set to produce between 170,000 to 200,000 oz Au this year. This is one of Barrick's smaller operations. Also producing around 200,000 oz/y, the Yaouré gold mine operated by Australian mid-tier Perseus Mining came into commercial production in 2021. Yaouré has an exceptionally low AISC of just US$734/oz and has become the company's powerhouse, as CEO Jeff Quartermaine called it, accounting for up to 60% of the company's total gold output.

Three new gold mines will follow in the next two years. The first mine expected to pour gold by the end of this year is the Abujar gold project, a greenfield project developed by Tietto Minerals. Abujar holds a mineral resource of 3.35 million oz and can produce over 200,000 oz annually at an average AISC of US$804/oz. Already 80% complete, next in line will be the Séguéla gold mine of Fortuna Silver Mines, targeting first gold by mid-2023. In the first six years, Séguéla should deliver 133,000 oz/y, with an AISC over LOM (life of mine) projected at US$832.

The latest news came from Endeavour Mining, the operator of 250,000 oz/y Ity mine in Ivory Coast. Endeavour has recently announced a final investment decision for the construction of the Lafigué gold project and the mine will become operational by the end of 2024. Very similar to the projects enumerated above, the DFS for Lafigué contemplates a capacity of 200,000 oz/y, at a low AISC of US$831/oz. In a public release, Endeavour said the deposit was discovered with just US$31 million spent in exploration, which brings the discovery cost to just US$12/oz. These successes speak of the opportunity to find rich deposits that can be easily converted into mines, not only by majors, but by small explorers too.

Ivory Coast does well from a longer-term pipeline perspective too, as explorers like Mako Gold, Awale Resources, and Montage Gold advance steadily with their exploration programs. The latter has marked a significant milestone towards production, releasing the DFS at the Koné gold project this year. In line with the guidance of other producers in the country, Koné should also produce about 200, 000oz/y for 15 years. But Montage wants to grow the resource further, since the relatively low grade (0.8 g/t Au) requires a sizeable deposit. This year, Montage acquired the Mankoko JV project from Barrick and Endeavour, consolidating its landholding around Koné from 300 km² to 2,000 km². ■

Senegal

The lost-cost advantage spotlight

Main producers: Endeavour, IAMGOLD

Main juniors: Chesser Resources, Oriole Resources, Bassari Resources

"Over the past 10 years, the law has changed quite significantly, and with each change, the authorities have tried to yield more and more benefits from the extractive industries to rebalance the interests between investors and the population."

Maname Fall
Tax and Legal Manager, Sojufisc

With the planned expansion of the Sabodala-Massawa mine, owned by Endeavour Mining, Senegal continues to grow in the ranks of West African gold-producing nations. Currently with a production target of 360-375,000 oz for 2022, the company aims to see Sabodala-Massawa producing over 400,000 oz/y

But it is not raw output numbers that make Senegal worthy of attention, because, with only two large producing mines, its total gold output of 20.7 t/y renders it the 11th in the continent; furthermore, Senegal offers some of the lowest production and discovery costs in the continent. Publishing the DFS for the Phase 2 expansion at Sabodala-Massawa mine, Endeavour showed that it can boost capacity while driving down costs by supplementing the current 4.2 million t/y CIL plant with a 1.2 million t/y BIOX plant, a process technology which increases achievable gold recovery. First production from the BIOX plant is expected in early 2024. Sabodala-Massawa is already Endeavour's biggest operation by annual capacity and lowest-cost operation in the region, a notable double-feat for the biggest producer in West Africa.

Once Phase 2 expansion is completed, Endeavour expects an AISC of $576/oz over the life of mine, possibly one of the lowest in the world. Last year, Endeavour was the second most economic gold producer in the world, with an average AISC from its multiple jurisdictions greatly helped by the low numbers of its Senegalese mine.

Despite summoning the presence of leading companies like Endeavour Mining and IAMGOLD into the country, Senegal has not managed to attract many juniors. One of the most established of these is ASX-listed Chesser Resources, which is advancing the Diamba Sud gold project. Chesser recently published the MRE of 781,000 oz at 1.6 g/t for Diamba. Though the resource is still modest, the scoping study released this March pointed these ounces to be very economic, said Andrew Grove, Chesser's CEO: "Diamba Sud is amenable to a low-cost, low-risk CIL gold extraction at a 2 million t/y production rate producing approximately 100,000 oz/y at an AISC of US$820/oz. The first two years of mining the oxide resource are particularly strong with production of 244,000 oz/y at an AISC of US$545."

Grove thinks the project has a lot more to deliver. Chesser made two new small discoveries at Karakara and Bougouda, and, with more such satellite resources, it hopes to deliver a 10-year project at 100,000 oz/y by mid-2023. Diamba sits just across the border from Barrick's Loulo-Gounkoto in Mali, in an area characterized by near-surface mineralization which makes it easy to identify anomalies. The challenge, according to Grove, is understanding what happens at depth: "This emerging gold belt will ultimately produce 2 to 3 million oz, but it's just a matter of really cracking the nut to see its potential," he said ■

Burkina Faso

Burkina Faso, a victim of bad news

Main producers and upcoming producers: Endeavour Mining, Fortuna Silver Mines, IAMGOLD, Trevali, Nordgold, Centamin, Orezone, West African Resources

Main juniors: Diamond Fields Resources, Sarama Resources, Tajiri Resources

> *The main challenge for the continent is not the market itself, but the security issues affecting the Sahel region, which is penalizing project development in countries like Mali and Burkina Faso.*
>
> **Cedric Fernandez**
> **Managing Director, Africa Power Services**

As more players flock to Ivory Coast, juniors, miners and their supporting service providers flee Burkina Faso. At least three companies have paused operations due to the worsening security situation. Russian miner Nordgold shut down its Taparko mine, calling force majeure. Avesoro Resources has also suspended operations at the Youga gold mine, while local Néré Mining ceased activity at the Karma mine, which it bought early this year from Endeavour. In June Karma was attacked by unidentified assailants, resulting in two casualties. Six others died in a gun attack on a convoy coming from the Boungou mine, operated by Endeavour.

Juniors are also taking a step back on operations, at least for now. Golden Rim and Arrow Minerals, both explorers with gold projects in the country, have paused their activity, focusing on projects in other jurisdictions. WSP Golder, one of the largest engineering and design service companies, withdrew from the country. To make matters worse, a flood at the Perkoa zinc mine, which resulted in the death of eight people trapped underground, forced Trevali, its operator, to close the mine. Adama Soro, the president of the Chamber of Mines in Burkina Faso, said the event at Perkoa put 2,500 jobs at stake and deprived the country from millions in tax revenue.

The economy is shaken by lower revenue streams, with gold output down by 8% in the first half of 2022 (H1) compared to H1 2021. The political situation is also frail after the country suffered two military coups this year. This, together with widespread poverty, foment further violence: "The origins of the conflict are not inherent to Burkina Faso, as violence spilled out from Mali and continues to ferment across the Northern Sahel. This makes it difficult for any individual country to contain the spread of violence on its own, especially since Burkina Faso does not benefit from any international forces to help fight the insurgents. We need a regional approach to change the course of events," said Soro.

Nevertheless, Burkina Faso is home to some of the best and biggest deposits in West Africa. Endeavour Mining has four mines in the country, making it the biggest producer not just in Burkina Faso but in the whole region. IAMGOLD's biggest mine, Essakane, is also in Burkina Faso, while West African Resources has recently started its 400,000 oz/y Sanbrado mine. Orezone also announced in September first gold at its Bomboré mine, expected to produce 178,000 oz/y for over 13 years.

Early exploration companies are also seizing opportunities in the country. This year, Diamond Fields Resources, a Canadian junior, acquired TSXV-listed Moydow Holdings and its portfolio of gold projects in Burkina Faso and Mali. The focus will fall on the Cascades deposit on the Banfora Gold Belt in the south of the country. John McGloin, the CEO, thinks that juniors must approach security differently than producers: "Unlike miners, who can barricade themselves within the site behind high walls and security guards, juniors have a much more direct contact with their surroundings. We must work a lot harder, especially on the social side, to create trust, and we have a brilliant local partner that is well entrenched with the local communities and the artisanals in the area. Southern Burkina Faso is a beautiful part of the country, and the quietest and most stable region, but that doesn't mean we can be blasé about the security challenges, because everything is well until it isn't," he said. ■

Adama Soro

PRESIDENT

BURKINA FASO CHAMBER OF MINES

> *We expect and encourage the new authorities to consider the alarming situation of the mining sector and provide effective fast speed solutions to the security issues affecting the country.*

What have been the main developments in the mining sector in Burkina Faso over the last year?

The biggest challenge remains security. For the past five years or so, mining activity has been interrupted multiple times due to security issues, and it is worrying to see that four mines have indefinitely suspended operations since the beginning of this year. Norgold shut down its Taparko mine in the country, while the Turkish mine of Youga (operated by Avesoro Resources) and locally-owned Karma mine both ceased activities. Meanwhile, the flooding incident at the Perkoa zinc mine forced Trevali to close down the site. Compared to H1 2021, gold output in the first half of 2022 was roughly 8% lower, with a drop of around 4 t of gold. Besides the security threat, the country has faced two military coups and sanctions from ECOWAS, which are impeding the country's development. At the same time, two new mines currently under construction will enter production in the next two years, both Orezone and West African Resources advancing phenomenally with their flagships in the country and proving that Burkina Faso is ground for terrific discoveries that can be turned into mines, on time and on budget.

Could you comment on the Chamber's reaction to the recent coup launched by the military ruler?

We expect and encourage the new authorities to consider the alarming situation of the mining sector and provide effective fast speed solutions to the security issues affecting the country.

What are the underlying factors that fuel the ongoing insurgency?

The political instability and legacy political frictions are not helping to bring stability because the efforts are not concentrated and unilateral, even though the different governments in place have put security at the top of their agendas. There are deeply rooted tensions along community and ethnic lines, as well as rival factions that compete for power, terrain, and ideology. There is no overnight solution – it will require time and a thought-out strategy to bring in sustainable peace solutions. The origins of the conflict are not inherent to Burkina Faso, as violence spilled out from Mali and continues to ferment across the Northern Sahel. We need a regional approach to change the course of events. Also, we cannot forget that Burkina Faso is ranked 184 out of 191 poorest countries in the world. Economic fragility and poverty are ruthlessly exploited by insurgents.

It's been five years since you established the Community Development Fund. How has this evolved?

Between 2019 and 2021, over US$200 million has been paid into the fund by mining companies. The issue remains the disbursement of this cash at the community level by the different municipalities tasked with the allocations for specific projects. Less than 20% of the cash generated has been allocated so far. This speaks to the problem of managing large amounts of money and translating these into meaningful projects. The Minister of Mines has undertaken a restructuring of the process to make sure that the money is handed out transparently, merit-based, and with a positive socio-economic impact.

Do you have a final message?

At the Chamber, we are committed to doing our best not only for the mining industry but for the whole country, to make sure it benefits from its rich resources and it overcomes existing challenges. Burkina Faso is a country of immense potential, and I want to thank all workers operating in the mines for their dedication and hard work against all hardships. They make mining possible in the country. ■

Mali

Recovering after sanctions

Main producers and upcoming producers: Barrick Gold, B2Gold, Resolute Mining, Hummingbird Resources, Firefinch

Main juniors: Roscan Gold, Toubani Gold, Compass Gold, Desert Gold, Robex Resources, Galiano Gold, Sylla Gold, Cora Gold, Firefinch, Kodal Minerals, Stellar AfricaGold, Marvel Gold, Leo Lithium, GoviEx Uranium

Mali suffered two military coups in the span of just 14 months, both led by Col Assimi Goïta and his junta. He first deposed Ibrahim Boubacar Keïta in 2020, and then again seized power from the transitional President Bah Ndaw and Prime Minister Moctar Ouane in 2021. Both times, the Economic Community of West African States (ECOWAS) imposed strict sanctions on the country, the first slew of sanctions firmer than the second, argued Liam Morrissey, the CEO of London-based security consultancy MS Risk: "ECOWAS responded quickly to contain the coup leadership by levying strict sanctions on the country. Mali was isolated except for the transfer of humanitarian aid. Comparatively, the response was milder after the second coup, which sends the wrong message."

At the beginning of 2022, Mali had its financial assets frozen, an active embargo on trade, and its borders closed, but the ECOWAS block lifted these measures in July after Mali promised to return to civilian rule and run elections in 2024 instead of 2026 as initially indicated. During the six-month period of sanctions this year, logistics became particularly difficult for the Malian mining industry. Dolores Biamou, the mining director for Africa at Bolloré Logistics, told GBR that new corridors had to be explored via Mauritania and Morocco to reach the mines in the country. Mauritania is not part of ECOWAS and did not cast off its neighbor.

The sanctions have also been a significant factor in the underperformance of the Morila gold mine, operated by Firefinch, who acquired the asset in 2020 from Barrick and AngloGold. The mine did not meet its production guidance due to the lack of equipment that could not be brought into the country while the movement of goods was restricted. In the latest letter to shareholders, chairman Brett Fraser wrote that Firefinch will no longer provide funding for its wholly-owned subsidiary in the country (Société des Mines de Morila S.A).

However, the country's biggest producers, Barrick Gold and B2Gold, saw normal production figures this year at their Malian assets. The massive Loulo-Gounkoto gold complex of Barrick Gold is on track to meet its 510-560,000 oz annual guidance following ramp-ups at the new underground mine at Gounkoto (the complex's third underground operation). Promising results from the Yalea Ridge and Gounkoto-Faraba targets are also indicating further life-of-mine extensions.

Barrick's peer in the country, B2Gold also expects Fekola to meet its guidance and produce between 570-600,000 oz this year, President and CEO Clive Johnson commenting that the mine was not impacted by the ECOWAS sanctions: "Throughout the COVID pandemic and the period of ECOWAS sanctions, the mine continued to operate normally and meet its production targets, while we maintained a strong working relationship with the interim Malian government. We welcomed the July decision of ECOWAS to remove the economic, financial, and diplomatic sanctions imposed on Mali in January 2022."

Meanwhile, Resolute Mining welcomed a new CEO, Terry Holohan. Using his experience as former COO for Resolute and his metallurgical engineering background, Holohan brought the operation back in line in terms of meeting its guidance and solving some of the issues that were causing the mine and the plant to underperform. "Syama is a huge project, with over 7 million oz Au in the ground, but the production is quite small, at 220,000 oz/y. We plan to double, if not triple, the size of the operation over the next five years. The ore body can handle such an expansion, especially given the recent exploration successes, and we are undertaking reengineering studies to debottleneck the operation accordingly," Holohan told GBR.

Hummingbird Resources has provided a downward update on its output for 2022, but this was attributed to planned essential maintenance rather than the political situation in the country. Mali is not yet sanction-free, as ECOWAS countries continue to exercise individual sanctions targeted at the members of the ruling junta and the transitional council, Reuters reported. ■

> *Barrick's status as Africa's biggest gold miner is underlined by the Loulo-Gounkoto complex, which routinely accounts for around 7% of Mali's GDP. It's been going strong for 18 years and its continued success in replacing depleted reserves gives it a lease on life of at least another 10.*
>
> **Mark Bristow**
> **President & CEO, Barrick Gold**

Liam Morrissey

CEO

MS RISK

> *The real danger is that some companies may still want to trade off the old business model of six years ago.*

Could you give us a sense of MS Risk' main regions of activity in Africa?

In the western Sahel we have been assisting client projects for 14 years. In East Africa we have been active in places like Ethiopia where we evacuated several mining clients during the turbulence in Tigray, for example. In Southern Africa the security situation has been more benign and so our work in places like Namibia and Botswana has been along the lines of due diligence, helping clients set up new projects and to ensure that end-client security and crisis plans are proportionate and fit for purpose.

Do you think the mining industry is showing greater awareness of the issue of security?

The growing focus on ESG is pushing companies to pay more attention to security due diligence. The days of deploying contractors to a new country and not asking their client about security arrangements are closing. More companies operating in the Sahel region are insisting that their clients demonstrate security and crisis response plans exist and work. For producing mines we see new procedures becoming commonplace on convoy management, route selection and use of charter flights to move most personnel. This signals that many companies are trying to raise their game to meet the shifting challenges.

How is the war in the Sahel evolving and what does this mean for mining companies?

The war is expanding geographically and in intensity. We now see terrorist violence in the northern regions of Togo and Benin. Pressure remains in northern Ivory Coast and it must also be building on the Ghanaian northern frontier, even if it is not yet visible. The political instability in West Africa is stimulating the war because these countries are not positioned to combat the insurgency. Despite their courage, the Burkinabé soldiers and gendarmerie take terrible casualties. To operate in the Sahel today, mining companies need to factor the direct and indirect impacts of the conflict including targeted attacks, murder, kidnapping and ambush, and with that, to have a scalable enterprise security framework ready for mitigation in such an environment. The real danger is that some companies may still want to trade off the old business model of six years ago. This example permeates across the West African theatre and is to be avoided if safety of people and protection of asset value is to be achieved.

West Africa has seen multiple governments toppled by military interventions. Are the new leaders gaining legitimacy after these coups?

We have seen a succession of military interventions in the last three years, including some that failed. It is discouraging that the current political climate seems to give signals that this is the way forward. Regional bodies such as ECOWAS have appeared inconsistent in how they approach each case. International donors such as the US and EU have severely restricted aid to new military juntas. This leads to regimes looking elsewhere for new friends and it may give encouragement to militants.

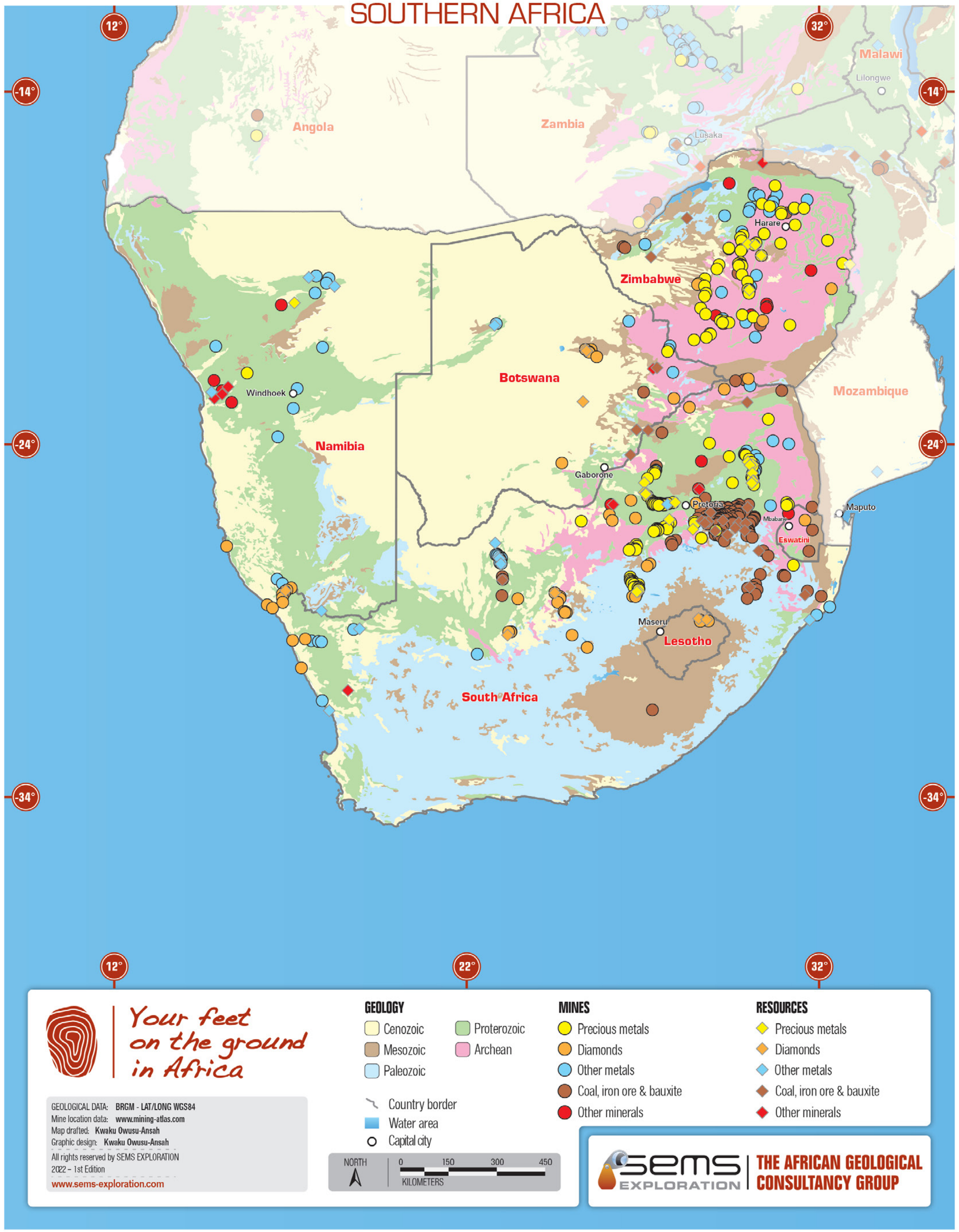
Could you unpack the link between artisanal miners and insurgents?

Organized crime bandits and terrorists influence illegal miners and use them as a funding stream. Recent studies suggest the value of illicit gold production is between US$1.5 billion – US$5 billion annually. If warlords and terrorists can tax a percentage then we realise just how valuable this activity is to driving instability.

MS Risk has successfully supported large-scale displacements of artisanal miners from client properties many times and in different countries. These are sensitive operations with safety, legal and ethical considerations. When done inappropriately, like we have seen some untrained security forces using heavy-handed tactics that resulted in fatalities, the tensions between locals and miners grow because artisanals will not blame the army, but the western mining companies that were being protected.

Do you have a final message?

Just like the frog that does not realize it will boil while sitting in a gradually-heating pot, so is the Sahel war becoming so normalized that people do not realize the seriousness of it and think they are immune to it. A lot of people are still not confronting the reality on the ground and, because of that, are not resourcing correctly. MS Risk can help them understand the real risks, tactically, operationally, and strategically. ■



Southern Africa

Highlighted projects

SOUTH AFRICA The Steelpoortdrift vanadium project

"The DFS for the Steelpoortdrift project confirmed that we can achieve the results stipulated in the PFS without any cost blowouts. The US$1.2 billion NPV is very similar to what we obtained previously, and we obtained the same production rates of 12,000 t/y of flake (vanadium pentoxide), which will increase to 20,000 t/y after year five.

In the next six to 12 months, we will be focused on three main areas: The first one is to engage funders to get debt funding in place and prepare for equity funding. The second is to secure a suitable offtake agreement with a reputable partner with the right balance sheet to satisfy lender requirements. And the third one is to work on pre-construction work streams that came out of the DFS so that we are shovel-ready to give debt funders the assurance we'll be ready for construction by the time we reach a final investment decision. Our view is that we can raise between 60 and 70% of the capital through debt, and the remaining balance through equity.

Jurie Wessels, Exec. Chairman, Vanadium Resources

BOTSWANA The K.Hill manganese project

"Our K.Hill project, together with its surrounding deposits – Otse and Lobatse - has changed substantially in recent years. Since April 2021 and our updated PEA, we have focused exclusively on high-purity manganese sulfate to go into the battery market rather than producing the metal and then entering the high-purity sulfates. As a way of curbing emissions associated with its production, we developed a flow sheet which allows us to go straight from ore to sulfate and skip the production of a metal as an intermediary step. This allows us to cut down costs and CO2, which puts us in a very competitive position against China.

Last year, we were looking at a small 1.7 million t inferred resource, which we have grown to a total of 5 million t indicated plus inferred resources for K.Hill. Once the current infill drilling campaign is completed, we should convert most of those inferred resources to indicated. Among our listed peers, Giyani already boasts the highest grades, so if we can increase the average grades and feed grades, we can add more value. With the 5 million t resource, we have a base case for 200,000 t/y throughput for a 20 years LOM – but this does not account for Otse or Lobatse, which should put us comfortably above 20 years."

George Donne, VP of Business Development, Giyani Metals

ZIMBABWE The Zulu lithium and tantalum project

"Today, our focus is Zulu Lithium, a well-mineralised pegmatite swarm 80km east of Bulawayo. We temporarily suspended work on the DFS, seeing the uptrend in spodumene prices and the growing demand. Suzhou TA&A has pre-purchased spodumene to the value of US$34.6 million, which has allowed us to commence with the construction and commissioning of the pilot plant to produce SC6 in Q1 2023.

The plant is "pilot" in the sense that it complements the DFS. Capacity-wise, it is able to produce 4,000 tons/month of spodumene. The other reason why we call it a "pilot plant" is because we have not yet concerned ourselves with increasing the grade of tantalum to become sellable, but this will require a simple gravity-based concentration process added into the circuits. Until then, we will stockpile that material and submit it to further test work. The plant has a modular format, with interchangeable components which gives us great flexibility."

George Roach, CEO, Premier African Minerals

South Africa

The dimmed colors of the rainbow country

> *Mining is a heavy energy consumer, with demands on the megawatt scale. At the same time, however, a sometimes-stiff mentality hinders the wider adoption of solar solutions.*
>
> **Hadyr Koumakpai**
> **General Manager, JA Solar**

MAIN OPERATORS:

- **Gold**: Harmony, Gold Fields, AngloGold, Sinbanye StillWater
- **Coal**: Exxaro, Jindal, Glencore, Menar
- **Vanadium**: Bushveld Minerals, Vanadium Resources
- **Diamonds**: De Beers, Petra Diamonds
- **Manganese**: South32
- **Platinum**: Impala, Sibanye StillWater
- **Zinc**: Vedanta Zinc
- **Copper**: HBIS, Anglo American, Orion Minerals

"Rainbow Nation" is the nickname popularized by Nelson Mandela during his first month in office to describe multiculturalism in post-apartheid South Africa, but the rainbow metaphor is also becoming of the country's mineral richness; a colorful mix of gold, diamonds, platinum, coal, vanadium, zinc, manganese, copper, chrome and titanium. Unfortunately, over the past year, South Africa has experienced severe and more frequent power blackouts that have shadowed the mining industry's growth. Even though the South African mining industry reached a remarkable milestone in 2021 as the mineral output value reached 1 trillion Rands (R) for the first time, according to the Minerals Council, the sector has incurred multiple losses, not only on account of lower commodity prices, but caused mostly by domestic hurdles – power, transport infrastructure constraints, and a wage strike.

This June, the country reached its worst-ever stage of load shedding, measured as level six out of eight, which translates to several hours of power cuts every day. The national utilities company, Eskom, has allowed for 6,000 megawatts (MW) to be cut to avoid the collapse of the national grid, following multiple breakdowns at the outdated and reportedly mismanaged power facilities. "South Africa has been starved of sustainable power, and while the government has not let the power cuts from Eskom impact the industry, we fear that it could degenerate and trickle down to mining operations like ours," commented Debratna Nag, the CEO of Jindal, one of the main anthracite coal producers in the country.

The other big concern is the inability of Transnet, the public freight-rail operator, to handle the volume of coal and other bulk exports. In 2021, Transnet saw over 1,000 km of cable stolen. The rise in copper prices has incentivized vandalism of public infrastructure in the last few years. Furthermore, zama zamas (illegal miners) cost the industry about R7 billion a year, reports The Economist. In November this year, a coal-loaded train derailed on the main export route going to the Richards Bay Coal Terminal, forcing Transnet to declare a two-week force majeure to clear the trucks as violence erupted. This was the sixth force majeure invoked by the operator in less than two years, according to Bloomberg. On top of these losses, coal, chrome, iron ore, and manganese exporters were unable to move R65.3 billion worth of goods after a 12-day labor strike at Transnet hindered exports. Transnet resumed work once a 6% wage increase was agreed upon, but backlog disruptions will run into 2023.

80% of South Africa's power comes from coal, which makes the country one of the largest polluters in the world, accountable for 13% of GHG globally. In the next 30 years, the country will have to spend US$250 billion to build wind and solar plants. The financial muscle to push for the change mostly comes from the international community. In the aftermath of COP26 climate talks, South Africa secured US$8.5 billion from the UK, US, Germany, France and the EU to finance this transition. But the country also showed will for change.

The double-pressure from both local players (disquieted with aggravating loadshedding) and international voices (concerned with the country's CO_2 footprint) is propelling policy changes. In a landmark decision, President Ramaphosa extended the licensing threshold for private projects from 1 MW to 100 MW. The electricity reform is a real game changer for miners, but also for private power suppliers. Rob Hounsome, Africa regional managing director at SLR Consulting, a global environmental and advisory services company, commented on its significance: "The reduction of certain red tape for private power producers is bound to have a profound effect on the economy. Creating opportunities for the private sector in the renewable energy space is crucially important for the development of the economy, and we're seeing a lot of mining and renewable energy clients benefiting from being able to self-generate renewable energy."

Orion Minerals, one of the largest holders of mineral rights in South Africa with over 6,000 km^2 of land, can already see how the availability of renewable energy is changing the economics of its project. In the original bankable feasibility study (BFS) for the Prieska copper-zinc project, Orion used a standard Eskom energy rate at 119 cents/KW/hour, but the updated BFS relies on renewables that come at a third of the cost of grid (35-45 cents/KW/ hour): "The market is moving thrillingly fast and new doors are opening, which also means the input parameters for developing new mines need to be reviewed. Suddenly, mines like Prieska, which were already on a path to carbon neutrality, could even potentially become a net carbon sequestrator making them attractive targets for financiers looking to offset carbon credits," said Errol Smart, the CEO of Orion.

Large investors in the country are already counting on renewable sources as part of their development plans. Ivanhoe began the construction of the first solar-power plant for its Platreef PGM project in Q3 of this year with commissioning expected next year. Developments to bring Platreef into production in 2024 are going well, according to Marna Cloete, Ivanhoe's president: "Tremendous activity is taking place at our Platreef project as construction and development ramps up. Our first significant milestone was in May 2022 when we concluded the construction of the Shaft 1 production changeover. With Shaft 1, planned to be the first production shaft, now in operation and hoisting rock from underground, Ivanhoe is focusing on further construction activities to bring Phase 1 of Platreef into production by Q3 2024."

Vedanta Zinc International has also initiated plans to develop solar power solutions at its main assets in South Africa, taking advantage of the recently relaxed legal framework for renewable power generation: "Vedanta is already in discussions with different players to make the Black Mountain underground operation and plant, as well as Gamsberg phase 1 and plant, 100% reliant on solar and wind power. South Africa has a lot of potential for developing the renewable sector, with intense sun and wind that can be harnessed to create energy and with many companies like us ready to invest in green energy," said Pushpender Singla, executive director and CFO at Vedanta.

Vedanta is investing R7 billion to expand the Gamsberg zinc mine and R600 million for a new plant at the Black Mountain Cluster. Both are top-tier assets, Gamsberg being once the largest zinc resource in the world, able to produce almost 1 million t/y. Currently, the mine makes a quarter of that amount, but its operators want to bring it closer to its former glory and double its output to 500,000 t/y. Platreef is also projected to become Africa's lowest-cost producer of PGMs, nickel, copper and gold. ■

> *Exploration in South Africa was historically conducted by large, well-resourced mining houses – but this role has now been left to junior companies. Unfortunately, South Africa is currently ill-equipped to support and nurture the smaller exploration and mining companies*
>
> **Andrew van Zyl**
> **Director and Principal Consultant, SRK Consulting**

Namibia

On care and resurgence

MAIN OPERATORS:

- **Gold**: B2Gold, Osino Resources, Deep South Resources, Antler Gold
- **Lithium**: Lepidico, AfriTin
- **Zinc**: Trevali Mining, Vedanta Zinc International
- **Uranium**: China National Uranium Corporation, Swakop Uranium, Paladin Energy, Orano, Elevate Uranium, Madison Metals, Forsys
- **Graphite**: Northern Graphite
- **Rare Earths**: Namibia Critical Metals
- **Diamonds and gems**: DeBeers (Namdeb Diamond Corporation) Sperrgebiet Diamond Mining, Sakawe Mining Corporation
- **Copper**: Dundee Precious Metals, Trigon Metals
- **Iron ore**: Lodestone Namibia

South Africa's northern western neighbor, Namibia, shares the geological heterogeneity of the Rainbow Nation, offering a spectacularly diverse endowment of gold, base metals, battery metals, uranium, rare earths and diamonds. However, out of the 25 mines identified by the country's Chamber of Mines, nine are under care and maintenance. A revival of both brownfield projects and greenfield investments has begun to unfold, but only in selected commodities.

Out of the different resources it holds, Namibia has best managed to differentiate itself in uranium, becoming the second largest producer after Kazakhstan, according to the World Nuclear Organization. This feat is mostly on account of the Rössing and Husab mines, some of the biggest uranium mines in the world. In 2007, the government placed a moratorium on new uranium prospecting licenses, creating a tough environment for investors. The ban was only lifted 10 years later in 2017. In the two years that followed, at least 52 new uranium licenses were granted, setting the country up for a strong comeback in uranium production. This year, the China National Nuclear Corporation (CNNC), the owners of the Rössing mine, reported that the country's uranium output jumped to its highest level in history, overtaking both Australia and Canada in the league of top producing countries. The country's uranium output is bound to increase as a pipeline of new projects is developing. Canadian uranium explorer and developer Madison Metals has secured several licenses in the proximity of Rössing and Husab mines, beginning a campaign of early exploration work. Australian explorer, Elevate Uranium, has managed to identify over 20 million pounds (lb) of uranium resource estimate since acquiring the Koppies tenement in the Namib desert three years ago. After raising A$11.5 million at the end of 2021, the explorer intensified exploration efforts: "We are now spending more than ever on an aggressive drilling campaign. We have two drill rigs in operation, the first one focused on expanding Koppies and the other one at our Capri project," CEO Murray Hill said.

At the same time, investments in base metal projects have been largely stalled, leaving many brownfield developments in a state of limbo. One of the most awaited investments in the African zinc industry, Trevali's expansion project at the flagship Rosh Pinah mine, is on hold. The Rosh Pinah 2.0 (RP2.0) expansion, which would add 86% more volume into the mill and extend the life of mine beyond 2032, was brought to a halt after a court order forced Trevali to suspend trading on the TSX to face inquiries related to a flooding incident at a site in Burkina Faso. Trevali announced the sale of its 90% interest in Rosh Pinah.

> *In my view, Namibia is probably the best African jurisdiction, coming second place in the continent within the 2021 Fraser Institute Survey of Mining Companies Report. The country remains widely under explored, but I believe it will receive more attention especially after having just surpassed Canada as one of the world's top exporters of uranium*
>
> **Darrin Campbell**
> **President, Namibia Critical Metals**

> *Northern Graphite found in Namibia a permitted graphite project that can easily expand into a world-class operation. Using our experience as the only graphite producers in Canada, we want to get there first, be the quickest to reach the market and capture the high growth in graphite prices*
>
> **Hugues Jacquemin**
> **CEO, Northern Graphite**

Other zinc projects are simply waiting for better market conditions. One of these is the Skorpion zinc mine of Vedanta Zinc International, a subsidiary of the large Indian group Vedanta Resources. The plant, on care and maintenance since 2020, could double its current capacity from 150,000 t/y to 300,000 t/y with a R6.5 billion investment that would create up to 1,500 jobs, according to the operator. Vedanta had plans to convert the refinery at Skorpion so that it can cater to both oxide and sulfide ore types, but these fell through: "High energy prices have derailed this plan. Unfortunately, the refinery is not economically feasible at the current energy prices. Namibia imports power from South Africa, which also runs a deficit and deals with problematic load shedding," said Pushpender Singla, executive director and CFO at Vedanta Zinc International.

On the copper front, the reopening of the historic Kombat mine also reached a temporary stalemate. Trigon Metals reopened the mine, but subsequently went back to drilling and studying higher-grade opportunities from the open pit, not included in the original mine plan. Trigon will be publishing an updated resource at the beginning of 2023 to incorporate resources from the open pit, and wants to start production from the underground in 2024. Another copper project, the Haib copper deposit, was abruptly stalled when the Namibian government removed the license from Deep South Resources, its operator. The deposit has been in the hands of multiple operators since the 1950s when it was first discovered, but none of the prospectors managed to prove positive economics for the large resource. Pierre Léveillé, president & CEO of Deep South Resources, is confident the decision will be revoked by the end of this year: "The Ministry renewed the claims over all these years without seeing the results it hoped for. Deep South Resources is the first company in 55 years to demonstrate that the project could be viable and can have a positive economic impact. We showed it was possible to extract the metal at a very low OPEX and CAPEX," he said.

Deep South Resources is waiting on a verdict from the High Court of Namibia in February 2023.

Gold and battery metals saw fewer obstacles. The main gold producer in the country, B2Gold, is going ahead with the underground expansion of the Wolfshag mine, which has an annual guidance between 165,000 and 176,000 oz Au for 2022. ASX-listed Lepidico is fully-permitted and shovel-ready to start construction once it has secured financing for its Karibib lithium project. Production should commence in 2025.

Global efforts towards the energy transition have not only sparked more interest in uranium but are also opening new frontiers in graphite and rare earths, resources required in battery production. This year, Canadian producer Northern Graphite acquired the Okanjande graphite mine, on care and maintenance since 2018. Together with Okanjande, Northern Graphite also took hold of Okorusu, an old fluorspar plant located 22 km away from the Okanjande that can be converted to a graphite processing facility. The company is still deliberating whether to convert the existing processing facility or relocate it on the mine's site to bring down operational costs. Regardless of this decision, Northern Graphite wants to start graphite production in Namibia in the next one to two years.

Meanwhile, rare earths developers are making big strides. Namibia Critical Metals, a TSXV-listed company active in Namibia since 2011, recently signed a JV with the Japan Organization for Metals and Energy Security (JOGMEC) for C$20 million to fund exploration at the Lofdal dysprosium and terbium deposit in exchange for 50% interest in the project. Lofdal is a rather unique heavy rare earth project, according the company's president, Darrin Campbell: "Lofdal is one of only two xenotime-type heavy rare earth deposits under development in the world, as far as we are aware. After a significant drilling campaign in 2020, we increased the size of our resource from 6 million t to an astonishing 53 million t, with 4.7 million kg of contained dysprosium and 725,000 kg of terbium."

Namibia Critical Metals is moving steadily towards the release of a PFS in the next 12 months. ■

Botswana

Botswana, the "Switzerland of Africa"

MAIN OPERATORS:

- **Diamonds**: Lucara Diamond, Gem Diamonds, Debswana
- **Manganese**: Giyani Metals
- **Copper**: Koemacau Copper Mining
- **Uranium, Nickel and Cobalt**: A-Cap Energy

It is a Eurocentric habit to compare African countries to a Western reference, but it was with complimentary intent that Botswana earned the nickname of "the Switzerland of Africa" thanks to its stability and prosperity. These qualities Botswana shows exemplarily in an African context. Botswana is the second most democratic country in the continent and 30st in the world, according to the 2021 Democracy Index by the Economist Intelligence Unit. This sparsely populated country with only 2.3 million people in a territory as big as France's – if we can allow for another European reference - has one of the highest GDPs per capita in Africa, and a GDP growth curve that has been moving in rhythm with the demand for diamonds, of which it is the biggest global producer by value.

The dependency on diamonds has resulted in fluctuations so steep that, in 2020 when the global diamond sector went dormant, Botswana's economy dropped by -8.7% GDP, whereas in 2021 it jumped up 11.4% under more buoyant conditions. Despite these trepidations, Botswana achieved a high GDP growth average of 4.5% between 1995 and 2022.

De Beers, in partnership with the government of Botswana under Debswana, has four mines in production, of which Jwaneng is the world's richest by value. Other international players with major operations in the country include Canadian-based Lucara Diamond and UK-based Gem Diamonds. At the Karowe mine Lucara Diamond is investing US$547 million into an underground expansion that will be ready in 2026. This will be the country's first underground mine. Eira Thomas, Lucara's CEO, told GBR why diamond mining is at home in Botswana: "Botswana was built on diamond mining. Diamonds were discovered not long after Botswana gained independence more than 50 years ago, and the mining of diamonds was central to the country's growth and industrialization – infrastructure, schools, and hospitals were funded from mining revenues. The mining act was modelled after the Canadian one. 99% of Lucara's employees are Batswana, including our top management."

These qualities that recommend Botswana as "Africa for beginners" have also attracted interest in mining for other materials. These could help the country escape the volatile nature of diamond valuations.

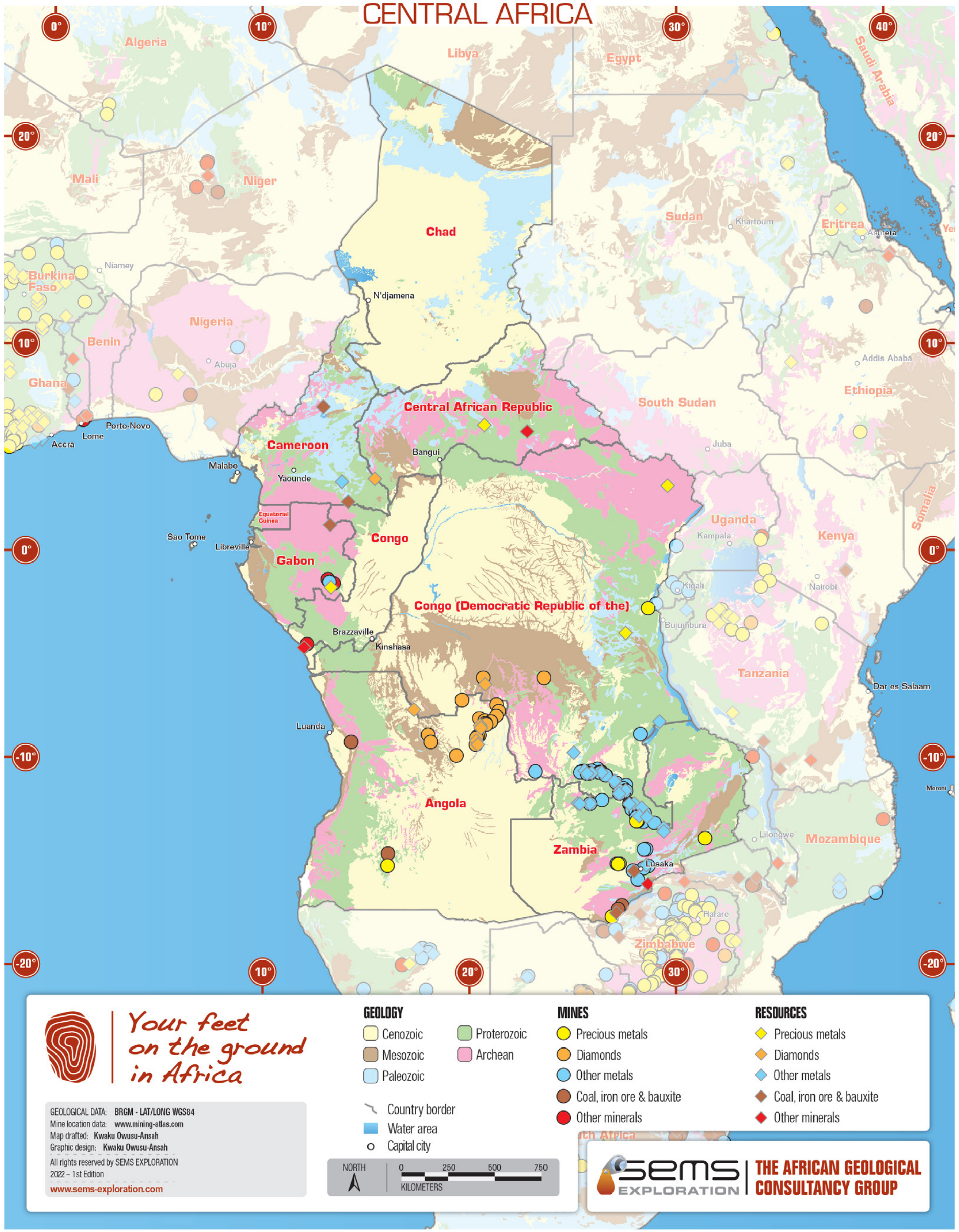
Last year, privately owned copper and silver mining company Koemacau completed construction of the first copper and silver mine in the country, drawing attention to the Batswana share of the Kalahari Copper Belt, which stretches to Namibia. The underground Koemacau mine produced first concentrate in 2021 and is set to produce 60,000 t/y copper and 2 million oz/y silver concentrates for 22 years.

Unlike diamonds, whose value oscillates with the health of the global economy and the appetite for luxurious items, copper and other metals tie into the future-facing energy transition. A-Cap Energy, an Australian company, is exploring opportunities for uranium, cobalt and nickel in the country. The Letlhakane uranium project is one of the top 10 largest undeveloped uranium resources.

> *Botswana was built on diamond mining. Since beginning our activity in the country almost a decade ago, we have matured our sustainability agenda and are committed to leaving a lasting positive impact in the country.*
>
> **Eira Thomas**
> **CEO, Lucara Diamond**

The company is also drilling the cobalt and nickel Wilconi project, hoping to tap into the battery market.

A more advanced battery metals project is Giyani Metals' K.Hill high-purity manganese sulfate. The developer published an updated PEA focusing on battery-grade materials. Giyani is well-funded with C$17 million in the bank to complete the FS and a demo plant. All the ingredients seem to be there to bring into being Botswana's first battery metals project: "Being in a mining-friendly jurisdiction and already at the FS stages we are on the radar of a few financial institutions that want more exposure to manganese," said George Donne, VP business development at Giyani. ■



Central Africa

Highlighted projects

DRC — The Giro gold project

"Over the last year, we carried out a comprehensive drilling campaign that includes 3,500 m of Diamond (DD) and 1,200 m of Reverse Circulation (RC). At this point, we completed the DD campaign very successfully, confirming the consistency of our mineralization and hitting phenomenal intercepts of around 200 m at 1 g/t and 400 m at 0.5 g/t Au. These results have shown that the deposit is evenly mineralized and indicative of a low stripping ratio.

Alongside this procedural work, we will likely follow up with more exploration drilling, doubling down on testing the size of that extension zone. As we move to the next stages, be this a scoping study or a PFS, we will be undertaking a capital raising, where we would like to attract more sophisticated, large funds, as well as institutional investors."

Conrad Karageorge, CEO, Amani Gold

DRC — The Exclusive Trading of rare earth concentrates

"We are the first company to export monazite sands from the DRC since 1981. Since April 2022, we have sold 750 tons of concentrates, but want to ramp up to 1,000 tons per month. We have a 70:30 partnership with a state-owned organization and we set up a counter with various cooperatives to source the concentrates. Upon receiving these, Auxico's role is to analyse the material, pay the supplier according to the concentration of certain elements (prioritizing neodymium and praseodymium), arrange the sale to different parties, and look after the entire logistics process. We want to make sure to offer full traceability of the material from the person that brings it to the counter all the way to the ports where it lands as per clients' instructions. Auxico is also looking at ways to obtain third-party certification to show we operate in good governance."

Mark Billings, Executive Chairman, Auxico Resources

ZAMBIA — The Munali nickel mine

"CNM is currently the only nickel operator in Zambia. Our focus is uniquely devoted to Munali, a mine that was hanging on the edge of a cliff back in 2019, losing millions of dollars monthly. For the past three years, we have worked ceaselessly to resurrect the asset and bring it to stability.

Munali has now significantly surpassed its original design of 300 tonnes per month at 10% nickel in concentrate to produce at a current capacity of 350-400 tpm at 12.5% nickel, a premium grade that is extremely desirable. The concentrate is polymetallic, containing copper, cobalt, platinum, and palladium, besides the main product; nickel. Munali is finally profitable, this year recording an EBITDA of US$23 million.

One of our long-term strategies is to investigate the full beneficiation of nickel in Zambia. Instead of using a large smelter, which is how most nickel is refined, we would use a high-pressure acid leach and solvent exchange electrowinning process to make a 99.999% pure nickel sulphate for battery manufacturing. Extracted and refined using green energy, the product would have a negative carbon footprint."

Anton Mauve, CEO, Consolidated Nickel Mines (CNM)

The Democratic Republic of the Congo

Good practices require validation

MAIN OPERATORS:

- **Copper and Cobalt**: Ivanhoe Mines, Zijin Mining, Glencore, Eurasian Resources Group, Chemaf, MMG, CMOC
- **Gold**: Barrick Gold, Amani Gold, Loncor Gold
- **Lithium, Tin, and Tantalum**: AVZ Minerals, Alphamin, Tantalex Lithium Resources
- **Rare Earths**: Auxico Resources

One of our greatest accomplishments was discovering and constructing the Kamoa-Kakula Mining Complex. Phase 3 is expected to increase copper production capacity to approximately 600,000 t/y. This production rate will position the Kamoa-Kakula Mining Complex as the third-largest copper mining operation in the world.

Marna Cloete
President, Ivanhoe Mines

An upbeat mood permeates the mining industry in the Democratic Republic of the Congo (DRC). The economy has carried the momentum of 2021 into 2022, with GDP growth declining only by 0.1% from the 6.2% registered last year. Foreign direct investment grew by 14% in 2021, according to UN body UNCTAD. Most investments went to the mineral sector.

But the main reason for celebration is the monumental increase in copper production; the DRC climbed from the fourth to the third biggest copper producer in the world in 2021, after Chile and Peru, with an output of 1.8 million t in 2021 versus 1.3 million t the year before. Next year, the DRC is expected to hit the 2 million t/y mark for the first time. In 10 years, it can reach 3 million t/y copper, overtaking the current total output of Peru. These giant leaps are almost singlehandedly driven by expansions at the Kamoa-Kakula copper complex, set to become the third-largest copper mining operation in the world by 2024. Operations at Boss Mining, located in the Lualaba and Haut-Katanga provinces, were also restarted in November this year, after almost three years of being held on care and maintenance by its operator, Eurasian Resources Group (ERG). Boss will bring onstream about 1,800 t of copper cathode and 300 t of cobalt hydroxide every month by March 2023, as well as creating 750 local jobs.

The DRC also seems apt to grow the production of cobalt and start exporting lithium. Surprisingly, significant production volumes of battery metals may emerge from recommissioned tailings. ERG's Metalkol RTR (Roan Tailings Reclamation) became the second largest standalone cobalt operation in the form of two legacy tailings deposits hosting circa 110 t of reserves. This successful - and undoubtedly more sustainable - model of mining tailings instead of virgin deposits is also developed by Tantalex Lithium Resources, an explorer that holds a license for the Manono Kitotolo lithium and tin tailings. The Manono deposit was mined for tin between 1910 and 1980. Hadley Natus, the chairman of Tantalex, thinks more projects like Manono will come up in Africa: "I believe there are more tailings products on the continent. Mining tailings is not only the cleanest form of mining but also the cheapest: Except for rehabilitation costs, mining costs are negligible," he said

What is striking about the DRC is that its dozen or so mines (and, in some cases, the leftover tailings) overtake in size and grade most other resources in the world. A handful of mines operated by Glencore, Eurasian Resources Group (ERG) and a few other players supply 70% of the world's cobalt. In gold, DRC's only mine - the Kibali gold mine operated by Barrick Gold - is bigger than any other in Africa, producing 812,000 oz at a head grade of 3.62 g/t Au in 2021.

Nevertheless, the DRC is routinely placed at the bottom of the list for investment attractiveness according to the Fraser Institute and other indexes. Poor governance and chaotic regulations are to blame. Though the trend has been to strengthen the existing legislative frameworks to encourage better mining standards and increased compliance, questionable policies and unclear actions befog any progress. For example, a new law requires all labs in the country to be ISO accredited. So far, all sounds right, but, Jack de Longueville, CEO of Robinson International Group, explained: "What we find problematic are side-line opportunistic requirements asking, for instance, to obtain the ISO accreditation from a Congolese company, which is an unjustified way of making extra money. There are also more and more government agencies all asking for independent audits and taxes. For example, instead of talking to one geology department, we need to see three or four of them, and we have just heard a new one has been created, which points to a multiplicity and overlap of regulatory actors that simply do not make sense."

Forward and backward moving regulations are confusing to the industry. Just a year ago, the government passed a decree which granted Enterprise Générale du Cobalt, a state-owned entity, monopoly over the artisanal cobalt mined in the country, but this year, Minister of Mines Antoinette N'Samba Klambayi is looking to cancel this decree. The state-owned mining company, Gécamines (La Générale des Carrières et des Mines), has also been at the center of multiple scandals. The Congolese ombudsman, the Inspectorate General of Finance (IGF), found significant irregularities in the management of Gécamines as part of an audit. More than US$400 million could not be traced in the books of the organization.

Private operators have also run into trouble with regulators in the past year. The operator of the copper-cobalt Tenke Fungurume mine, China Molybdenum, is the subject of a government-led investigation claiming that the miners understated the level of reserves to reduce payable royalties to Gécamines. China Molybdenum denies the accusation. MMG, the operator of Kinsevere copper mine, is to launch an international arbitration case against Gécamines after government armed forces unlawfully occupied two concessions close to its Kinsevere copper mine in September 2022, the plaintiff claims. MMG has recently announced spending US$600 million to expand the Kinsevere copper cathode and cobalt hydroxide production in the next two years.

In the spin of all this, mining operators are making efforts to prove that mining can be done sustainably, ethically and transparently in the DRC. Canadian company Auxico Resources is the first to export monazite sands from the DRC since 1981. As the exclusive sales agent for rare earth concentrates in the country, Auxico is exporting monazite (50% TREO) from the Bafwasende deposit in North Kivu, a province known to be among the most dangerous. Through a 70:30 partnership with a state-owned organization and a counter with various cooperatives to source the concentrates, Auxico analyzes the material received from the suppliers, arranges the sale to different parties and looks after the entire logistics process from the source to its destination in China. The more salient but most important role that Auxico plays is to instill credibility for the source of these concentrates: "Whether fair or unfair, there are commonly held negative perceptions about the DRC, so we want to make sure to offer full traceability of the material from the person that brings it to the counter (we identify and verify the individual, we mark the date and the quantity brought), all the way to the ports where it lands as per clients' instructions," said Mark Billings, executive chairman at Auxico Resources.

As it increases trading volumes, Auxico is also looking at ways to obtain third-party certification to prove good governance. Between April and November this year, Auxico sold 750 t of concentrates, but it aims to ramp up to 1,000 t per month in the future. Ultimately, the company would like to start its own operations instead of relying on supply from artisanal miners.

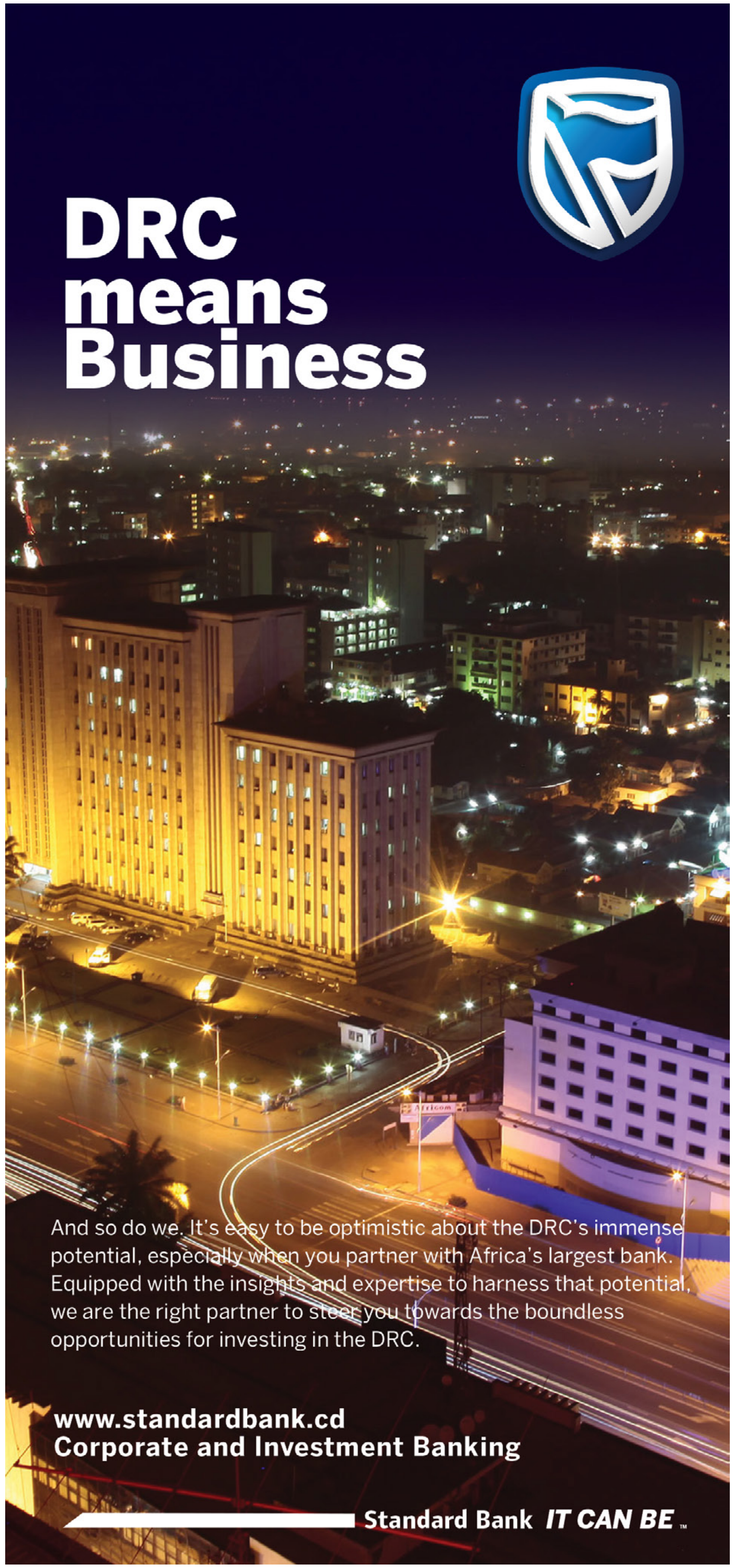
Older-established and larger players in the country are prioritizing social investments and, crucially, validating and exposing social investments by third parties for better credibility. Investments from Kibali reached US$4 billion

The entire world is looking closely at the DRC, scanning for opportunities in the green energy space. Though the country is an amazing place with extremely rich resources, work conditions can be hard. We are enthusiastic to be part of emerging opportunities.

Cécile Amory
President, MCSC (Mining Contracting Services Congo)

One area that will create bigger challenges going forward is likely to be around social license to practice and the underlying relationship between projects and their surrounding communities.

Rob Hounsome
Africa Regional Managing Director
SLR Consulting



in the last decade since the mine was first commissioned. US$1 billion went to taxes, royalties and permits. Its operator, Barrick Gold, was the first large mining company in the country to have its "Cahier de Charge" (or social term sheet) approved, in line with regulations introduced in 2018 - these require mining companies to have community development plans in consultation with local communities and local stakeholders. Barrick had the implementation of the commitment audited by the South African consultancy firm SRK Consulting.

Required by law or not, other players appeal to third parties to validate their good deeds in the country. ERG Africa, the entity under Eurasian Resources Group (ERG), had its 2022 Clean Cobalt and Copper Performance Report audited by PwC to show conformity with OECD guidelines on the sustainable extraction of minerals in the DRC. Moreover, at its recently reopened Boss mine, ERG started the renewal process of its five-year ESIA commitments and the formalization of its Cahier de Charges. Most recently, ERG together with the University of Kolwezi (UNIKOL) launched the ERG Mining Academy, which will receive its first student intake in January 2023. ■

"As demand for battery metals grows, places like the DRC are more heavily scrutinized as the birthplace of much of the world's global cobalt. Chinese players are taking a dominant position in many parts of Africa, and we have noticed greater transparency on their side, Chinese websites making available more information in multiple languages."

Andrew Reese
Global Industry Manager, Endress+Hauser (E+H)

Amedeo Anniciello

CEO
STANDARD BANK

"With mining companies currently enjoying high prices, exceptional production performance and robust supply chains, we anticipate that the sector will continue showing resilience and growth, remaining financially sound in 2023."

What have been the developments over the past year at Standard Bank DRC?

We have invested in capabilities through various digitization projects. Our recent development is the integration of the Mobile Money solution to our digital banking platform. It is an automated solution that allows clients to transmit high volume payment instructions from their business management software system into our online banking platform. It also enables them to receive transactional reports back into their management software. The system reduces operating costs for the client's as well as time spent on such operations.

How has the global inflationary dynamics played out in the country?

Where interest rates hiked to 18.5% back in 2020, they significantly decreased to 7.5% throughout 2022, indicating economic stability. The extractive sector is set to continue to drive growth, with the non-extractive sector still in recovery. The DRC's terms of trade have strengthened significantly over the past two years, largely as a function of elevated export receipts from the mining sector. However, this should be somewhat offset by recovering import growth, combined with a higher fuel import bill. It can be expected that the strong export performance should continue supporting the currency's stability, as would improvements in onshore FX liquidity conditions.

Could you remind our audience of the role that Standard Bank plays in the mining sector in the country and your key services?

With a dominant presence in the mining industry, we provide our clients with specialist technical expertise required to operate in the mining and commodities industry. Our clients have access to a multi-disciplinary teams, both on the ground and at the Group level, who can assist them with identifying opportunities in the mining and metals and help them navigate risks and challenges. We also can connect primary producers in Africa with large global markets, leveraging off of our institutional relationship with the Industrial and Commercial Bank of China (ICBC). Our strength lies in the ability to focus on the multinationals and their value chain, who are either buyers, distributors or supplier to whom we provide a wide range of banking, finance, trade, investment, risk management and advisory services. We are involved in major mining projects currently in development across Africa.

Could you comment on the current health and stability of the banking sector in the DRC?

DRC comprises of 15 commercial banks, mainly dominated by international and regional banks (mainly Kenyan and Nigerian). The sector remains relatively underdeveloped with one of the lowest banking penetration in the continent (6%).

Just like other sectors, the banking sectors was negatively affected by Covid-19, but has significantly recovered from the pandemic. Profitability levels as well deposits were at the highest levels in 2021. Deposits levels increased by more than 40% in 2021, as a result of the amendment made to the Mining Code, in which the surrender requirements were raised from 40 percent to 60 percent, coupled by high commodities prices.

The sector is very liquid, with a low loan to deposit ratio (less than 40%). Overall the banking sector remains sound and where it has been necessary, the Central Bank has stepped in.

What are your key objectives for 2023?

As a bank committed to Africa and its people, our mission is to drive positive, sustainable, and embedded growth in the DRC. In 2023, we will continue to develop and deliver the infrastructure needed for a digitally inclusive and connected market. We believe that the DRC is perfectly positioned for growth. So much so that we have embarked on a digital journey to become a platform business that will transform the way we do business in the future. We seek to unlock value for our clients by providing a comprehensive range of financial solutions under a unified offering. In doing so, we will continue to focus on developing long-term partnerships with our clients, the majority of which operate in the sectors that drive the country's GDP. ■

Zambia

New beginnings

MAIN OPERATORS:

- **Copper and Cobalt:** Barrick, Glencore, First Quantum, Deep South Resources, Arc Minerals, Moxico Resources, Midnight Sun, BeMetals Corp.
- **Nickel:** Consolidated Nickel Mines
- **Uranium:** GoviEx Uranium
- **Rare Earths:** Antler Gold
- **Gold:** Zambia Gold

"The regulatory environment is changing positively in Zambia where the change in government is generating a lot of optimism and also remodelling the relationship between the state and the mining industry."

John Martin
VP of Southern Africa, Kal Tire's Mining Tire Group

Zambia used to be biggest copper producer in the continent, but it traded places with its Copperbelt neighbor, the DRC, in 2013. The DRC came in strongly with lower production costs and higher grades, overtaking its longer-established competitor. The gap between the two grew wider and wider, as the DRC added about another 1 million t/y in this past decade, while Zambia only added a mere 130,000 t/y: Zambia was producing 751,000 t/y in 2013 and just 880,000 t/y in 2021. 2013 was also a turning point for FDI in the country, which slipped downhill and never recovered. According to the World Bank, FDI in Zambia was at US$2.1 billion in 2013, the highest in the last five decades. Today, it fell to negative 0.2% (-US$172,752), according to the latest data. Public debt, a mere 24% of GDP in 2014, exploded to 141% in 2020. Analysts from the World Bank estimate the debt to be between US$12 billion and US$18 billion.

This period of economic decline coincided with the erosion of democracy under the rule of former President Edgar Lungu. In 2019, the Lungu government tried to amend the constitution to give further powers to the executive power, something that commentators argued would have led to a constitutional dictatorship. These efforts failed and, finally, after new elections in 2021, President Hakainde Hichilema (HH as he is familiarly called) came to power with an ambitious vision and a series of structural and fiscal reforms to restore growth, promising "a new dawn for Zambia's mining sector" in his keynote speech at Mining Indaba conference in Cape Town. The new government puts mining at the center of the economic agenda and has an ambition to boost annual copper production to 3 million mt in 10 years – this would bring it to parity with DRC's own projections and place the Copperbelt, shared between the two countries, at the top of copper production worldwide.

The change of government has already brought a breath of fresh air into the economy. Post-election, market confidence grew considerably, the national currency, Kwacha, enjoying a sharp appreciation in the months following. Inflation came down from 24% a year ago to about 10%. IMF approved a US$1.3 billion loan to help the country restructure the debt accumulated over years of economic mismanagement, exacerbated by a severe draught in 2019 and the pandemic in the years after. Specifically targeting the mining sector, Zambia cut back the royalty rate, which is applied on a sliding scale mining royalty system based on the copper price. The country is said to have benefitted from royalties at a premium 10% rate over the past year due to the higher copper prices, according to The Exchange. Investors can also apply to incentives like discounts on income tax, and large investors are protected by IPPs (Investment Protection and Promotion Agreements) and can enter PPPs (Public-Private-Partnerships) to develop local infrastructure.

The first capital investments in mining did not fail to appear. Canadian-listed First Quantum Minerals, the biggest operator in the country, announced an expansion worth US$1.35 billion at its Kansanshi mine. AngloAmerican made the first investment in 20 years in the country after signing a JV with junior explorer Arc Minerals. After Glencore sold its 73% interest in the Mopani mine, transferring back the interest to ZCCM (who holds 10% in Mopani), South African miner Sibanye-Stillwater showed interest to buy Mopani.

The country is also attracting more explorers. Deep South Resources, a junior with a flagship project in Namibia, has recently acquired three exploration licenses in Zambia: Chililabombwe, Luanshya West, and Mpongwe. Pierre Léveillé, president and CEO at Deep South Resources, compared the attractiveness of the Copperbelt to other regions: "The Copperbelt is home to elephant deposits, not easy to come by in Canada or in the US, and rarer and rarer in Chile and Peru. Moreover, the political environment in many Latin American countries is changing for the worse, while Zambia has become a much more attractive jurisdiction following the recent government change. The permitting process is also incomparably faster than in a jurisdiction like British Columbia, where it can take up to 20 years."

In November, Deep South announced it has begun a soil sampling program on the three licenses after being granted the Environmental Project Briefs from the government. Another active junior in the country is TSXV-listed Midnight Sun, which completed over 2,600 meters of drilling in 2022 at the Solwezi copper license.

More advanced is GoviEx Uranium, the only company focusing on Zambia's uranium opportunities. GoviEx expects to complete the FS for the Mutanga uranium project by the first half of 2024. "We really like Mutanga because it is a simple, open-pit, heap-leach operation with very low acid consumption," said its CEO Daniel Major.

On the horizon of Zambia's new dawn economy lies a bigger goal: Zambia wants to become a manufacturing hub for batteries and EV accessories. The country plans to create a free economic zone facility in each of its 10 provinces and has signed a bilateral agreement with neighbor DRC to create a joint hub. Existing producers are keen to align in this long-term vision and take advantage of the incentives introduced. The operators of Munali, Zambia's only nickel producing mine, think the asset has become extremely relevant to the Zambian battery value chain: "One of our long-term strategies is to investigate the full beneficiation of nickel in Zambia," said Anton Mauve, the CEO of Consolidated Nickel Mines. ■

Albert Halwampa

DIRECTOR
ZAMBIA DEVELOPMENT AGENCY (ZDA)

Could you introduce ZDA's mandate and the role it plays in Zambia?

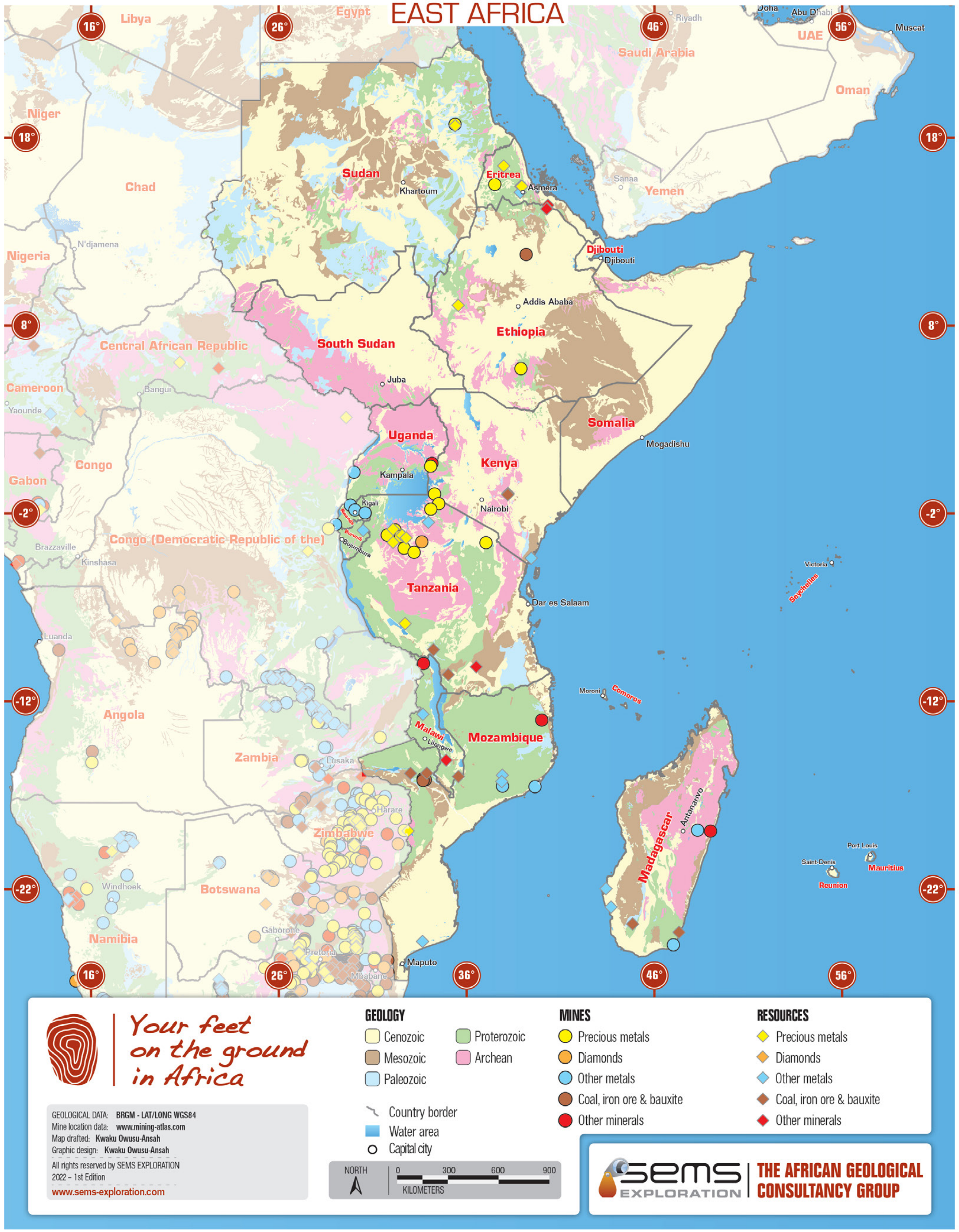
Reporting under the Minister of Commerce, Trade, and Industry, ZDA's mandate is to promote investment and trade, as well as encourage local and international investors to enter joint ventures in key sectors of the economy. Almost 70% of Zambia's population depends on agriculture, whereas mining generates as much as 80% of the country's foreign exchange. Using the proceeds from copper production, we must ask ourselves, as a country, how to prop up other sectors like agriculture, energy, tourism and manufacturing.

Could you explain how important is mining within Zambia's growth plan?

Zambia is the second largest copper producer in Africa, but the country also holds deposits of cobalt, manganese, gemstones, gold, and other minerals, particularly those relevant to the green revolution. Zambia produces about 800,000 t/y of copper, but the government is projecting annual production of 3 million t/y in 10 years.

What are some of the concrete measures to attract FDI in the mineral sector in Zambia?

One of the most notable fiscal changes has been the revision of the royalty rate so that this is fair and allows for reinvestment in greenfield exploration. Also, Zambia provides various incentives to attract investors: together with their exploration or mining license, investors can also apply for zero customs duty on imports of equipment and machinery for mineral processing purposes. Also, by investing a minimum threshold of US$500,000, mining players can obtain discounts on income tax. For companies investing more than US$10 million, they can sign an IPPA (Investment Protection and Promotion Agreement), which guarantees the assets will not be nationalized or seized regardless of future governments. The current government is also promoting Special Economic Zones (SEZ) specifically designated for the production of EV batteries and accessories. Mining firms qualifying as local investors with processing facilities within those special zones and exporting will benefit from tax holidays for 10 years. Finally, infrastructure developments are also high on the agenda to create an enabling environment. Most of the copper today is trucked, but we think there are great opportunities to develop the railway system and create greater export efficiencies. Investors are invited to form public-private-partnerships (PPP) and co-invest with the government. All PPPs are exempt from VAT as per 2023 National Budget. ■



East Africa
Highligted projects

TANZANIA — The Nyanzaga gold project

"OreCorp took over Nyanzaga as an earn-in agreement in 2015, before gaining full ownership in 2019. Over these years, we have been working through major changes in the country, focusing on getting our special mining license approved. Back in 2017, the regulatory direction was geared towards increasing government participation, with increased royalty rates and strongly legislated local content rules. Nyanzaga is the first gold mine born into a new regime. Two of our seven directors on the board are representatives from the government, which retains 16% free-carried interest.

Based on the DFS published in August 2022, Nyanzaga will be the biggest gold project built in the country in the past 15 years, producing annually approximately 250,000 oz/y of gold for the first decade. The mine will comprise an open pit and an underground operation. The DFS reported an AISC of US$954/oz, a post-tax NPV5% of US$618 million and IRR of 25%. The CAPEX is estimated at US$474 million with a payback period of 3.7 years. First gold production is expected by mid-2025."

Matthew Vates, CEO, OreCorp

MALAWI — The Kayelekera uranium mine

"The Kayelekera mine operated between 2009 and 2014, producing about 11 million pounds (lbs) uranium over that period. What we liked most about this asset was that it was a past producer that delivered a high quality product, which was accepted by all major Western conversion facilities. We recognized, however, that Kayelekera was a high-cost producer, operating at US$35/lb in 2014, which was above the uranium spot at that time. Rendered uneconomic, the mine was shut down. We defined four areas of improvement to reduce the operating costs and improve the operability of the mine:

The first is energy, which represents about 20% of total cash costs of the operation. We were able to convert the energy for the process plant and the camp from the original diesel gensets used in 2014 to a hybrid power system, bringing down our energy costs from about 35 US cents to 10 US cents Kw/hour.

The second item we have been looking at is acid recovery, sulfuric acid accounting for 15-20% of our total operating costs. We incorporated a technology called nano-filtration to recover sulfuric acid from the elution circuit and feed it forward to the leach circuit, recovering about 60 tonnes per day or 25% of the total consumption.

Thirdly, we focused on increasing our feed grades using ore sorting technology. And, finally, the fourth area of focus was to redesign and expand the capacity of our existing tailing dam. For the first seven years of Kayelekera 10-years LOM, we can now use the existing tailings dam. In our mining plan, we will mine from the pit for only six years, beyond which we will move to treat stockpiles. Once the pit has been abandoned after year 6, we will then use the pit for tailings disposal, significantly reducing our sustaining costs and closure costs."

Keith Bowes, Managing Director, Lotus Resources

SUDAN — Block 14 gold project

"With the experience of bringing onstream three mines in the last decade, we are confident we possess the inhouse technical expertise to develop the Block 14 gold project in Sudan into a producing mine.

Sudan had a vibrant oil industry for many years, which encouraged a reasonable level of industrial development to support the industry. When South Sudan seceded from Sudan, it was left with few producing oil assets, but the infrastructure and supporting industry remained. Sudan also has a significant pool of well-educated mining people who have not have the chance to gain practical experience in an industrial setting but are very willing to learn. We have a chance to train people to our standards so that we can run our mine to the same standards that would apply in North America or Australia. Yes, we have a challenge of starting from the beginning in a new country, but we did this before in Cote d'Ivoire, and we did it well. Politics in North-East Africa has had its challenges but we believe that Sudan is on the path to establishing a stable form of government."

Jeff Quartermaine, CEO, Perseus Mining

Tanzania

A new framework for Tanzania

MAIN OPERATORS:

- **Gold**: Barrick, AngloGold Ashanti, Shanta Gold, TRX Gold, OreCorp
- **Graphite and Rare Earths**: Black Rock Mining, Peak Rare Earths
- **Diamonds**: Petra Diamonds

The President has been very vocal about the importance of foreign investment and has established a clear mandate to facilitate FDI and reduce red tape. In the last 12 months, multiple framework agreements have been approved in graphite, mineral sands and diamonds, as well as in the LNG sector.

Bardin Davis
CEO, Peak Rare Earths

At the end of 2021, at least four mining framework agreements in graphite, mineral sands, and diamonds were signed in Tanzania, marking the end of a tumultuous regulatory regime that started in 2017. At that time, the Parliament passed a series of legislations, known as the 2017 Mining Laws, that mandated a 16% free carried interest (FCI), restricted the export of raw resources for beneficiations outside of the country, prohibited the adjudication of disputes over natural resources in foreign courts, and demanded service providers cede 20% of equity to indigenous companies. Of these, the FCI and local content obligations caused the most concern – and the most confusion, according to a review by DLA Piper.

To get a better sense of what that period meant for the mining industry, GBR spoke to Charles Rwechungura, managing partner at the Tanzanian law firm CRB Africa Legal: "During this difficult time, the government was often hostile to mining companies and investors, taking arbitrary taxation against many players. Tax collection used to be chaotic and very hard on mining." he said.

Over that period, Barrick's acquisition of Tanzanian-focused Acacia Mining for US$1.2 billion in 2019 was the most catalytic for the country's mineral sector. Acacia had been stranded in a long tax dispute with the government, to which Barrick paid US$300 million to settle. Today, Barrick's two large Tanzanian mines, Bulyanhulu and North Mara, are on a path to reaching a combined production of half a million oz/y, the mark of a tier-one deposit. Other companies are still looking for a resolution. Winshear Gold has been locked in a five-year dispute with the Tanzanian government over its SMP gold project. Now more focused on its Peruvian assets, Winshear launched an arbitration case against the government in 2020.

The country's political landscape drastically shifted after former president John Pombe Magufuli died of Covid in March 2021. Mr. Magufuli was succeeded by his Vice President, Ms. Samia Suluhu Hassan, the first female president for the country and the only female head of government in Sub-Saharan Africa. "Mama Samia," as she is known, took on a different path compared to her predecessor, winning the praise of the international community for reversing Tanzania's plunge into authoritarianism and isolationism through more tolerant and liberal economic policies. For the mining industry, the government issued the Mining State Participation (SPR 2022), updating the framework for JV arrangements between mining companies and the state.

This October, the mining sector accounted for 7.3% of Tanzania's GDP, in line with the government's plan to bring the industry's contribution to at least 10% by 2025. Gold is the country's largest foreign exchange earner, but the country is also targeting investments in nickel, graphite, tanzanite, cobalt, diamonds, and rare earths. BHP placed a vote of confidence on the credibility of change in Tanzania after recently announcing a US$50 million investment in the Kabanga nickel project, with a further US$50 million to follow, subject to conditions. This marks the re-entry of the major not only to the country but in the continent. The Kabanga project is developed in partnership with the Tanzanian government, which retains a 16% interest as per the law.

Black Rock Mining is one of the four companies that has established a JV framework agreement with the government under the new rules in December 2021. Adding together the 30% tax rate, 4% royalties and inspection fees, and 16% free carried interest, the state is a 50% partner of the Mahenge graphite project. "The framework agreement set up the mechanics and governance principles for JV companies, which are necessary to attract debt finance and run the company," said John de Vries, the CEO.

Mahenge is a world-class, 26 years LOM deposit that can deliver 340,000 t/y graphite concentrate at 98.5% purity. Other tier-one projects deserve attention. The Ngualla rare earth project of ASX-listed Peak Rare Earths boasts to be one of the world's largest, highest-grade, undeveloped rare earth projects, with a life of mine of 24 years backed by a recently published BFS. The quality of such projects is bound to elicit further interest in Tanzania's other prospects outside of gold, thinks Bardin Davis, CEO, Peak Rare Earths.

Besides large deposits and a now-functional regulatory environment, Tanzania is also recommended by its good infrastructure. For its flagship Buckreef gold project, developed together with the State Mining Corporation of Tanzania (STAMICO), TRX Gold enjoys excellent connections via paved road as well as access to human capital in the heart of Lake Victoria, a region hosting AngloGold's Geita mine and Barrick's Bulyanhulu Complex. However, the years of contraction in the mining space took a toll on the services sector, which shrunk from underinvestment: "The services sector remains under-developed after many equipment suppliers of drilling machinery left. Access to capital is also very challenging in Tanzania as the banking sector is not up to standard and does not understand mining very well. Everything needs to be done on a cash basis rather than relying on debt," Albertus Viljoen, the co-founder of local construction firm Amazon Mineworks, told GBR. ■

Looking East

Untrodden jurisdictions

Uganda has substantial mineral wealth, but it needs explorers and investment to define the scale of those mineral occurrences. When we started working at Makuutu, we knew we were looking at a large system, but we never thought it would so large. For those companies looking for hidden gems, they need to go to locations that have not been explored before.

Tim Harrison
MD & CEO, Ionic Rare Earths

With the notable exception of Tanzania, most East African jurisdictions remain largely untrodden. Summarizing the specific circumstances of each jurisdiction would result in oversimplification and error by omission. It suffices to say that, in countries with a brief or non-existent history of mining, regulations are improperly defined, local services difficult to come by, infrastructure often limited, any of which can make or break the prospects of a new mine. Conflict and terrorism, most bloody in the northern regions of Mozambique and the Tigray region of Ethiopia, but also political unrest, recent in Sudan, are also weighed against geological opportunity. Mineral and non-mineral resources abound under the soils of each of the mentioned jurisdictions, with Ethiopia, Sudan and Tanzania standing out for gold, Kenya for its gemstones, gold, titanium and iron ore, while Mozambique holds some of the largest untapped coal deposits in the world and Madagascar has large deposits of nickel, cobalt and ilmenite, mostly undeveloped. Perhaps it is the provocation of these dormant resources, in the context of higher commodity prices, that is attracting multiple mining and exploration companies to these jurisdictions.

Sudan

Perseus Mining acquired all the shares of Orca Gold in Northern Sudan, and thus came into possession of the Block 14 gold project, expected to produce over 200,000 oz/y for 13.5 years. Perseus is the first publicly listed producer in the country and augurs well for the reputation of Sudan. Sudan is believed to be the third largest gold producer of the continent, but the exact data is hard to come by. The country's main mine, Hassai gold mine, is owned by two private entities, La Mancha Resources and Ariab Mining company, while artisanal miners contribute substantially to the total gold output. 90 tons of Sudanese gold reach global markets every year.

Ethiopia

Oslo-listed Akobo Minerals adventured to a remote area close to the Akobo River in Ethiopia and found a small but incredibly rich gold deposit. What it did not find was suitable infrastructure: "Close to the South Sudanese border, this extremely remote area was never mined before and lacked all basic infrastructure. Setting up the logistics and getting in supplies was incredibly difficult, but we carried on with trenching, soil sampling and RC drilling to build our geological model. In 2019, we did our first core drilling and struck a bonanza-grade gold deposit unlike anything else seen before, with high grades at an average of 22.7 g/t Au in the resource estimate, and 40.6 g/t in Indicated resources," said Jørgen Evjen, CEO at Akobo Minerals.

The area around Akobo's site has been occupied by over 40,000 alluvial miners who destroyed the biodiversity. Akobo launched a "tree nursery" to try to restore the natural ecosystem.

Madagascar

Rio Tinto is one of the only – and largest – operators in Madagascar. David Alexandre Tremblay, managing director of Rio Tinto QIT Madagascar Minerals (QMM), told GBR that the protection of the environment is the biggest challenge the ilmenite producer faces in the country. Beginning operations in 1998, Rio Tinto made the first big investment in the private sector, laying down the regulatory foundations for mining in the country. US$350 million of its US$1 billion investment went on building public infrastructure. The major is now investing assiduously in renewables, which will make QMM the first carbon-neutral mine of Rio Tinto by 2023. "Ever since we started in the 1980s, our key concern was to minimize the impact on the environment. If I could name one challenge of operating in

Madagascar, it would be the protection of the environment and its biodiversity. I look at the immense scrutiny we receive as a positive thing because it keeps us on the edge in our efforts to do our best thing for the environment and the communities around us," said Tremblay.

Malawi

Malawi is one of the latest African countries to start formalizing a mining strategy. The EITI member is a small producer of uranium, gemstones and coal, mining contributing to less than 1% of the national GDP. In a recent speech at the US-Africa Leaders' Summit in Washington, President Lazarus Chakwera identified mining as one of the most promising sectors for unlocking Malawi's growth, together with agriculture and tourism. There were only four mining companies active in the country, Lotus Resources (uranium), Sovereign Metals (rutile and graphite), and Globe Metals and Mining (niobium and tantalum), before Lindian Resources, an Australian explorer with bauxite projects in Guinea, acquired the Kangankunde rare earths project in the country in 2022. Asked what attracted the company to Kangankunde, Lindian's chairman Asimwe Kabunga said: "While we are still in the early stages of development, research carried out at Kangankunde has shown the site is highly prospective for extensive rare earths mineralisation with strong grades. We view the project as an opportunity to create value for all stakeholders and play a key role in the emergence of Malawi as a globally recognized mining jurisdiction."

Lindian has completed 2,895 metres of RC drilling and raised A$16 million to underpin the development of the project as part of its Phase 1 mine development drill program. ■

David-Alexandre Tremblay

MANAGING DIRECTOR

QMM (RIO TINTO QIT MADAGASCAR MINERALS)

Could you provide us with an overview of QMM's history and current operations in Madagascar?

Our interest in the in the Anosy region started in the late 1980s, and it took about two decades of social and environmental impact assessments before making the final investment decision (FID) for the project. In 2015, we made the FID for the US$1 billion project, US$350 of which went to shared infrastructure (roads, electricity, port through private- public partnerships). We began operations in 2008. We mostly (90%) produce ilmenite – TiO_2 titanium oxide used primarily as a white pigment in paints and coatings – and 10% monazite and zircon by-products. 80% owned by Rio Tinto and 20% by the Malagasy government, QMM employs 2,000 people and has led to the creation of 11,000 secondary jobs.

How has the mine evolved in recent years?

Just in the last two years, we grew production by 30% and we are expecting to achieve an additional 30% ramp-up in the next two years. The future looks very exciting for ilmenite, and the high TiO_2 content makes our product particularly attractive for smelters. We have seen a small drop in prices due to compounding factors like the war in Ukraine, the rise in fuel prices, and the slowdown in the Chinese economy post the pandemic, but we expect strong demand in future years.

QMM announced it will build an 8 MW solar and 12 MW wind power plant to supply QMM with renewable energy. Can you tell us more about this project?

Our goal is to see QMM become the first carbon-neutral mine of Rio Tinto by 2023. We signed a 20-year power purchase agreement with CrossBoundary Energy (CBE) to operate and maintain the energy facilities, starting with an 8 MW solar facility that will become operational this year, followed by the 12 MW wind facility (consisting of four wind turbines) to be completed in 2023.

These will be combined with the 8.25 MW of lithium-ion battery bank to ensure stability. Once fully operational, we will reduce our GHG emissions by 60%. For the remaining 40%, we are opting for nature-based solutions, like planting 2,000 ha of forests around the mining reef to sequester carbon, as well as expanding conservation zones and switching to renewable-powered transport and machines to reach net zero.

The electricity we generate powers both our operations as well as the town of Fort Dauphin, which means we will be supplying the 80,000 people community with clean and reliable energy at lower production costs.

Can you elaborate on your conservation efforts?

Ever since we started in the 1980s, our key concern was to minimize the impact on the environment. This is an extremely rich and sensitive natural environment, with tons of species unique in the world, and sometimes unique even to the area covered by our mining lease. So far, we have managed to preserve three conserve three conservation zones for 2,000 ha of forests, and we are also investing in water treatment facilities to improve the quality of the water released from the site. ■

North Africa

Highligted projects

EGYPT – The Abu Marawat gold concession

"The project lies in the Egyptian sector of the Arabian Nubian Shield, is over 447 km² in area, and includes more than 10 targets. Hamama is the closest to development. Our Rodruin deposit drew significant attention as the first greenfields discovery in the country in the last 100 years – locals call it the "Lost Mountain of Gold". Abu Gaharish stands out as an analogue to Centamin's word-class Sukari mine, which is about 200 km from our sites.

Many things have changed in Egypt over the last four years. The government has recently introduced a tax, rent and royalty system for gold mining and exploration. In 2020, it launched a gold bid round which attracted the majors, with Barrick and B2Gold picking up exploration blocks in Egypt."

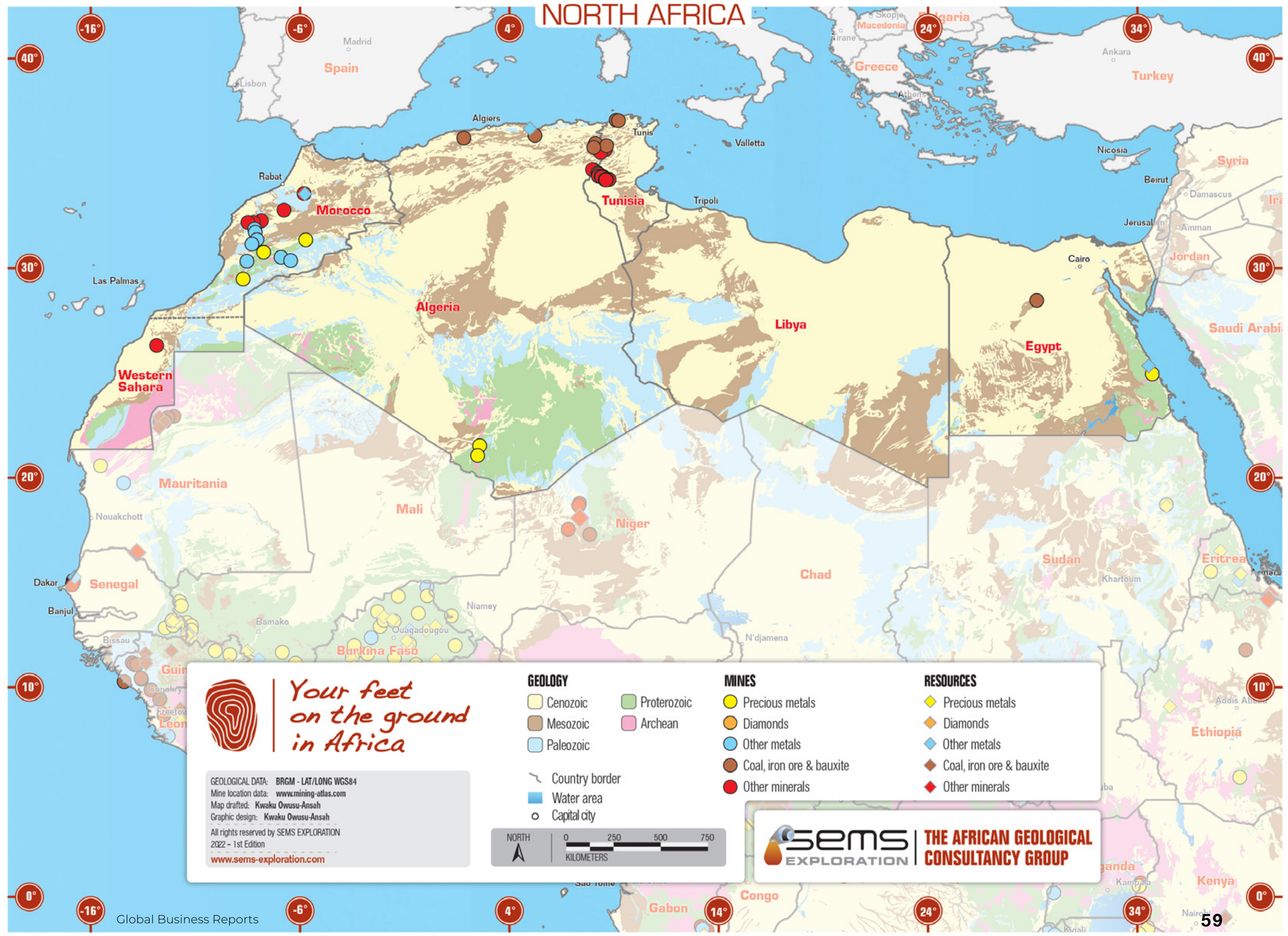
Tonno Vahk, Interim CEO, Aton Resources

MOROCCO – The Silver Hill copper & silver project

"Our early drilling in the Anti-Atlas region of Morocco yielded positive results. Some grab samples at surface showed an area with regular copper intercepts and silver grades ranging from 30 to 120 g/t Ag. We call this area "Silver Hill" because it has a history of silver mining that goes back almost 600 years, but this is a copper-silver-cobalt deposit. Nowadays, the value of the deposit is expected to be mostly copper (65%).

I believe this is a region that will continue to attract more attention. Morocco remains widely underexplored. As the world's largest phosphate producer, the country is not new to mining, but I think the focus on phosphate has meant that other opportunities have gone unnoticed. Again, I expect this to change. There are many discoveries waiting to be made in Morocco."

Jed Richardson, CEO, Trigon Metals

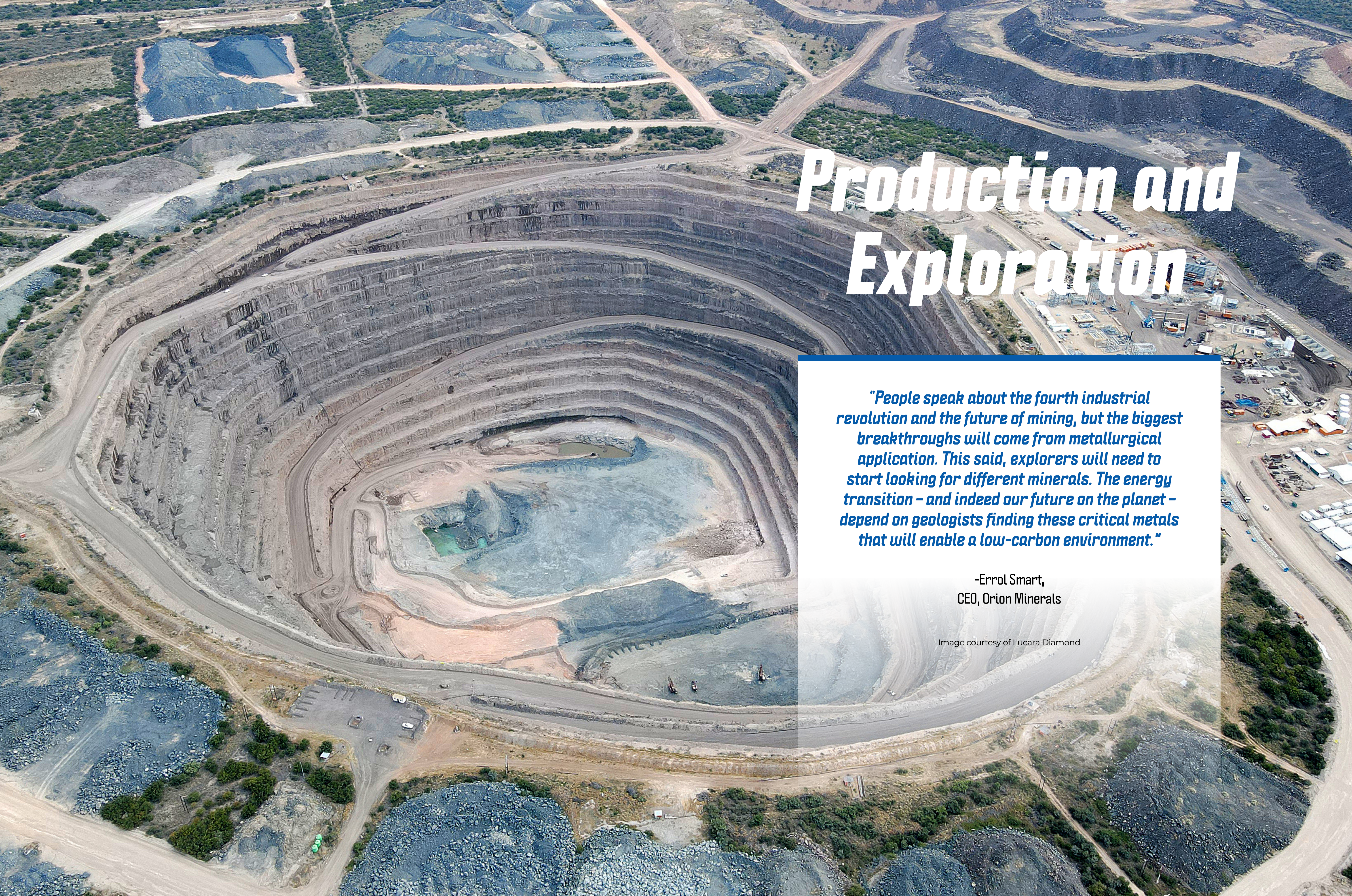


CROSS-COUNTRY COMPARISON

Sources: South African Revenue Services (SARS), Tanzania Revenue Authority (TRA), PwC, Grant Thornton, Service Public de l'Administration Burkinabè

	South Africa	Zambia	Botswana	Namibia	Ivory Coast	Ghana	Mali	Burkina Faso	DRC	Tanzania
GDP Growth % (2022)	1.7	2.9	4.25	3	5.5	3.6	2.5	3.6	6.1	4.5
Ease of Doing business (Ranking out of 190)	84	85	87	104	110	118	148	151	183	141
Attractiveness Score 2021 (Ranking out of 84 jurisdictions)	74	n/a	66	59	n/a	43	81	58	82	67
Inflation % (2022)	6.7	12.5	11.2	6.4	5.5	27.2	8	14.2	8.4	4
Political Stability and Absence of Violence/Terrorism Percentile Rank (0-100) 2021	21.7	48.11	84.91	63.21	16.51	49.06	2.83	7.8	8.49	30.66
Global Peace Index (Ranking out of 163)	118	56	48	68	108	40	150	146	158	86
VAT %	15	16	12	15	18	12.5	18	18	16	18
Lending Interest Rate %	7	9.5	5.3	11%	6.9	21.08	5.1	6.3	23.1	16.7
Royalty Rate %	0.5 - 7	5.5 - 10%	3 - 10%	2 - 10%	3 - 6%	5%	3%	3 - 8%	3.5 - 10%	3 - 6%
FDI as % of GDP	0.9	-1	0.2	-1,5	1.2	2.7	-1,51	3.1	3.1	1.1
Insights from explorers	"South Africa doesn't have the challenges that some of our fellow Africans in the north face, but because we are experiencing challenges from an elevated base of having been the decades-long economic powerhouse of Africa, we are perceived to be a more challenging environment." **Jurie Wessels, Exec. Chairman, Vanadium Resources**	"Zambia is very different today than it was three years ago when we started to clean up Munali. The current President is relentless to stamp out corruption, improve infrastructure, and encourage local beneficiation to produce electric batteries in the country to attract FDI and Western investors." **Anton Mauve, CEO, Consolidated Nickel Mines (CNM)**	"Our projects are very close to major highways and linked to five or six export terminals, unlike many remote manganese projects that would not lend themselves to having the processing plant onsite." **George Donne,VP of Business Development, Giyani Metals**	"Despite being endowed with incredible geology, Namibia has been largely overlooked from a modern exploration perspective. Its pegmatite belts hold many battery elements like lithium, tantalum and beryllium. The realization of this potential is already driving a big rush for licenses." **Anthony Richard Viljoen, CEO, AfriTin Mining**	"Political stability is the most important aspect and Ivory Coast is superior to most other jurisdictions in this regard. The more service providers come into the country, the more affordable the country becomes." **Rick Clark, CEO, Montage Gold**	"Ghana is the largest gold producer in Africa and the sixth largest in the world. The fact that the world's top gold producers chose to invest in Ghana out of all other places in the world says it all." **Luke Alexander, President and CEO, Newcore Gold**	"The current government has committed to elections in 2024, which was accepted by ECOWAS. Dealing with the government in the country has always been easy, as officials are open to dialogue and are very experienced in the resources industry." **Danny Callow, President and CEO, Toubani Resources**	"The village system and tribal hierarchies are very well-structured, but recent developments mean there is no room for complacency. Southern Burkina Faso is a beautiful part of the country and the quietest and most stable region." **John McGloin, CEO, Diamond Fields Resources**	"The Kilo-Moto greenstone belt hosts the Kibali 17 million oz deposit, one of the biggest in Africa. However, the area remains untested with many new quartz veins discovered by artisanal miners in the region." **Conrad Karageorge, CEO, Amani Gold**	"Tanzania is one of the few truly middle-income African countries. We benefit from hydropower grid electricity 60km away from the site, as well as a railway line that goes straight into the Port of Dar El Salaam, also 60km away." **John de Vries, CEO, Black Rock Mining (BKT)**

Production and Exploration



"People speak about the fourth industrial revolution and the future of mining, but the biggest breakthroughs will come from metallurgical application. This said, explorers will need to start looking for different minerals. The energy transition – and indeed our future on the planet – depend on geologists finding these critical metals that will enable a low-carbon environment."

-Errol Smart,
CEO, Orion Minerals

Image courtesy of Lucara Diamond

Precious Metals

Gold vies for investors' attention against the USD

> *Liquid assets are sold down irrespective of whether they have stores of wealth like gold might, and more investors are returning to cash, especially seeing a strong USD.*
>
> **Andrew Grove**
> **CEO, Chesser Resources**

MAIN COUNTRIES:

- **Gold**: Ghana, South Africa, Mali, Burkina Faso, Guinea, Sudan, Tanzania, Ivory Coast
- **PGMs**: South Africa (biggest in the world)

Gold is one of the first currencies used by ancient civilizations, but in modern times, it is the “anti-money” quality of gold that has been most appreciated, because no matter what happens with fiat currencies, the stock market, or other financial assets, gold preserves an intrinsic value as a tangible, quantifiable, permanent commodity. At the same time, its value is also arbitrary and highly speculative and a creature of market forces. Over the past two years, gold has honored its role as a hedge against uncertainty and crisis, going above the US$2,000/oz mark at the height of the pandemic and after Russia's invasion of Ukraine. Since then, it came down to around US$1,600/oz, a healthy price for the gold mining industry. Neither the price of gold nor the supply-demand balance trouble the industry as much as the twin pressures of frail investment sentiment and inflation, both linked to the USD.

The fundamentals are on the side of the gold mining sector. Gold supply, especially that which comes in premium deposits (large, open-cast, easy-to-mine) is shrinking. According to a report by the New York Times newspaper, the amount of above-ground gold only increases by 1.5% every year, while below-ground reserves are decreasing by 5%. The banning of Russian gold has also deprived the global supply of about 330 t of gold this year, about 10% of the total 3,500 t. Africa is emerging as one of the last places that could deliver top-tier deposits, as vast swathes of the continent remain underexplored. According to the World Gold Council, South Africa, Ghana, Mali, Burkina Faso, Sudan, the DRC, Guinea and Tanzania were the biggest producers of the continent in 2021. Over the last decade, the most ounces of gold worldwide were discovered in West Africa. While Ghana already holds some of the biggest mines in the continent, the gold veins crossing Mauritania, Mali, Senegal, Ivory Coast, Burkina Faso, Guinea, Liberia, Nigeria and Cameroon have seen little exploration by comparison. An aerial survey made by the Burkinabe government in 2018 found 2,200 possible informal gold sites, estimated to produce 100 t/y of illicit gold – almost the same amount that the formal sector produces every year. After clamping down on gold smuggling, Sudan climbed up to become one of the major producers in Africa, with 85 t of gold recorded in 2021.

About half of gold demand comes from jewelry, industrial and medical applications. This utilitarian part of demand has been stable, retail gold demand in particular picking up in Q3 of this year driven by Diwali celebrations in urban India, according to the World Gold Council. The other half of gold demand, that part which concerns gold as “anti-money” and which is driven by investors, has declined by 47% year-on-year in Q3, according to the same source. The weaker investor sentiment for gold assets, including gold mining stocks, is a negative reaction to a stronger dollar and higher interest rates. The dollar surged 15% this year as measured by the USD index (DXY), competing with gold as a safe-haven investment. Higher bond yields as a result of rising interest rates have also become attractive to investors, to the detriment of gold, which saw the fifth consecutive month of ETF outflows in September.

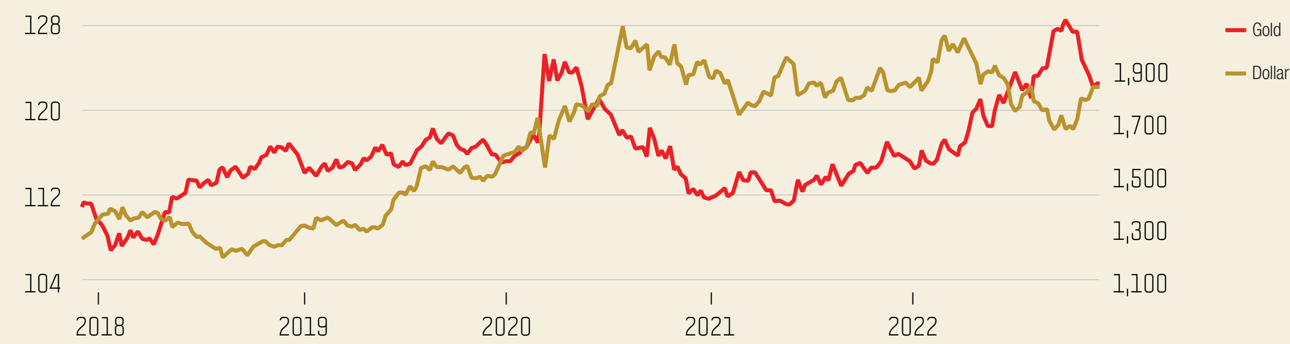
Nevertheless, gold returns outperformed most asset classes and the stock markets this year. Moreover, for non-US investors, gold did well in both nominal and real terms. Year-to-date gold returns declined 5% in USD, but in Euro, Japanese Yen and GBP, they grew by 7.5%, 14.7%, and 10.6% respectively in nominal terms, according to the World Gold Council. “We've seen the gold price sliding in USD, but the price in Euros, GBP, or Canadian dollars is still close to all-time highs. (Also), if we compare gold to other main indices like the S&P 500 or the NASDAQ, which are down by more than 20% year-on-year, gold strongly outperformed these, coming down by only 4%,” said Luke Alexander, president and CEO of Canadian junior explorer Newcore Gold with operations in Ghana.

To discuss the gold price is to discuss the USD. Based on the gold return arbitration model proposed by the World Gold Council, a fall in the USD would have an almost immediate numeraire effect on gold; just a 1% fall in USD resulting in a 0.88% rise in gold prices. But leaving aside the short-term, unpredictable dynamics for the USD, the macro-economic context remains characterized by uncertainty, a higher USD exporting further inflation into the global economy, while the Russian-Ukraine conflict continues to cast a deep, dark shadow on geopolitics, gas, and other commodity supplies. For more than five decades, gold returns have had a negative correlation with stock market returns, owning gold being seen as a hedge against market volatility. During recessions, crises, bear markets, and a volatile stock market, gold did well, and there is no reason to believe that it would be different this time.

“There is a lot of uncertainty in the world that would normal-

CORRELATION BETWEEN GOLD AND USD

Source: ANIQ, MacroTrends



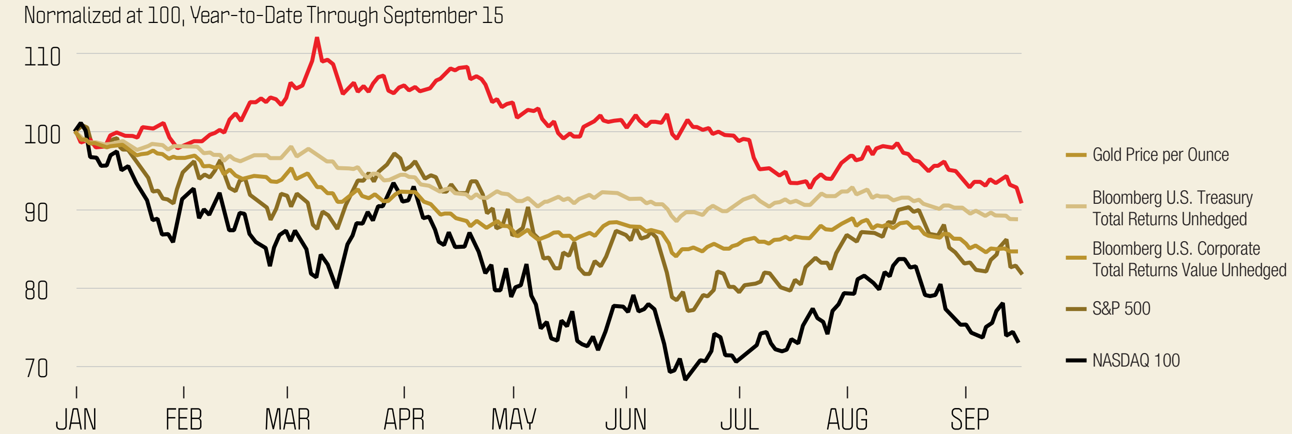
GOLD'S PERFORMANCE IN DIFFERENT CURRENCIES (AS OF SEPTEMBER 2022)

Source: Bloomberg, ICE Benchmark Administration, World Gold Council

	USD (oz)	EUR (oz)	JPY (oz)	GBP (oz)	CAD (oz)	CHF (oz)	INR (oz)	RMB (oz)	TRY (oz)	AUD (oz)
30 Sep price	1,672	1,706	7,779	1,479	2,312	1,650	43,723	382	30,975	2,612
YTD return	-7.4%	7.4%	16.4%	12.3%	1.4%	0.3%	1.3%	3.4%	29.2%	5.2%

GOLD REMAINS ONE OF THE BEST ASSET CLASSES IN 2022

Source: Bloomberg, US Global Investors



> *Africa could very well be the destination with the most economic and best-performing assets in the next 10-20 years. This is where we have been increasing our investments more than anywhere else in the world*
>
> **David Awram**
> **Co-founder, Sandstorm Gold Royalties**

ly push the gold price much higher. I don't see this going away anytime soon, but, in the short term, the main headwinds are coming from the strong USD and high interest rates," said Jeff Quartermaine, the CEO of Australian mid-tier Perseus Mining.

African gold projects showcase competitive economics amid inflation and weak sentiment

"The way I see it, the market looks terrible. Many resource companies suffered deep plunges in their share price in the past few months due to the uncertainty that prevails in the gold market, even though the price of gold has only dropped by about US$100 in the last month," said Craig Mackay, managing director of junior explorer Golden Rim Resources, which has recently raised US$4 million to fund a 5,000 m drilling campaign at its Kada project in Guinea. "In times like these, it all comes down to the quality of the asset and the ability to prove that quality," said Mackay, voicing a popular belief.

Like Golden Rim Resources, many African gold juniors have seen strong depreciations in their share prices and struggle to win the attention of equity investors, while debt has become more expensive and riskier. David Awram, co-founder and senior executive VP of royalty and streaming company Sandstorm Gold Royalties, one of the largest in the industry, told GBR that some banks tend to take a conservative view on financing projects in what are considered high-risk jurisdictions in Africa: "I struggle to identify what some call 'tier-one' jurisdictions. To me, every jurisdiction has risks, be it taxation, stability, or permitting lead time. Rather than focusing on one particular tier-one country or one risk type, we prefer to invest in a high-quality project," Awram said.

The African gold sector might just have some of the best project economics out there, according to Awram. We do not need to look far to find such projects. Gold producers like Perseus, a top 30 TSX performer over the last three years, produced half a million oz of gold at a margin of US$732/oz in the last year. For its Yaouré mine, which it brought into commercial production in 2021, the margin exceeds US$1000/oz at current market prices. This places Perseus towards the bottom of the cost curve and at the top of the cash flow yield curve relative to peers in North America and Australia.

B2Gold's Fekola mine in Mali also operates at a low AISC ranging between US$840-880/oz. Its CEO Clive Johnson said: "Despite ongoing cost pressures, the drawdowns of existing inventories, proactive management and the revised sequencing of some capital costs mean that consolidated cash operating costs and all-in sustaining costs in the first half of 2022 were lower than budgeted."

Orezone, West African Resources, Tietto Minerals, Fortuna Silver Mines, Endeavour and others are bringing forward projects mostly on time and on budget. Those juniors at an earlier exploration stage are also demonstrating positive metallurgical recoveries, low AISCs, large deposits, or a combination of these factors that render their projects attractive, and most importantly under the current market, de-risked. For its 781,000 oz at 1.6 g/t grade maiden resource estimate, Chesser Resources showed the ounces found are economic, amenable to a low-cost, low-risk CIL gold extraction at a 2 million t/y rate producing at an AISC of US$820/oz, conformant with what is seen in the region. "There are many benchmarks used in the industry, the bigger the better being the primary logic, of course. But there are other factors. In Africa, a project with a couple of million ounces draws attention, but one has to take into account whether these resources convert into reserves. The market likes to see circa seven to 10 years life of mine to have time to build the project, run it, and find more ounces to feed into the mine plan," said Andrew Grove, the CEO of Chesser Resources.

Low operational costs resulting from easy metallurgy, high grades, and access to cheap power are surely important to showcase, but most investors will first look at pre-production costs. CAPEX has been revised upwards over the past year. Juniors that are nearing the FS stage will have to account for larger CAPEX numbers, whereas those with a completed DFS may need to further review these numbers to capture inflation. Pasofino Gold, a junior developing the Dugbe gold project in Liberia, has just filed its FS report for a capital cost of US$435 million, with a post-tax NPV at 5% of US$524 million. Its executives think the capital requirement is a conservative take and it will likely come down, and that they put out defensible numbers rather than aspirational ones.

"We took an engineering-driven approach to the FS. The numbers are real; they reflect the inflationary pressures of the current environment, and they are the kind of numbers that a constructor could run with, while some of our competition out there will put out unbuildable figures. The market always looks at any CAPEX with caution, and in this environment, it is no different. It's up to us to show the market the upside potential we have at Dugbe, not just in terms of identifying more gold, but also cost savings," said Pasofino's CEO, Daniel Limpitlaw.

> *As a junior with a large landholding, we must be very clear on our strategy. We had to leave aside some targets where the occurrence of gold extended deeper and required more expensive follow-up drilling and stay focused on near-surface resources.*
>
> **Larry Phillips**
> **CEO, Compass Gold Corporation**

Juniors tighten the belt

The last couple of years have made the gold mining industry more impatient and risk-driven, eager to shoot out news releases every other week, but the current market asks them to pace down, demonstrate more conservatism and be careful with their spending. Producers have significantly expanded their exploration budgets in 2021, by as much as 100% in Endeavour's case. According to the Trade Law Centre (Tralex), Newmont, Barrick, Resolute and B2Gold have also invested more in exploration. Meanwhile, most juniors raised money last year, which should finance their activities into mid-2023 or later, depending on how they stretch their budgets. In this market, juniors are expected to refocus on cheaper exploration. For instance, OreCorp, the company behind the Nyanganza gold project in Tanzania, raised US$56 million in 2021, closing the book after just two hours. This year, many juniors gave a miss to the markets altogether.

"This is probably one of the worst markets I have seen in my career, especially for an explorer hoping to move into development," said Hugh Stuart, the president of Ivorian-focused Montage Gold. The explorer relied on self-financing, 70% of its shares being split between its largest shareholders (Barrick, Endeavour, the Lundin Group, and management): "This solid ownership protects and allows us to focus on building up our resource base through aggressive exploration, without depending on the markets for capital. So, for the moment, we are going to give the markets a miss and focus on creating more value from exploration," Stuart added.

With a yearly exploration budget between C$4 and C$5 million, Compass Gold, a junior explorer with a large property on the Yanfolila belt in Mali, had to be more selective in its drilling campaign this year, prioritizing near-surface, open-pitable resources, and leaving aside follow-up, more expensive exploration for a later stage. This strategy has led the explorer to two key mineralized zones that dictate the focus of its 2023 campaign: a 4 km strike length on the Massala mineralized zone, which contains eight discrete veins; and the Tarabala Zone, which has at least four veins within and 1.8 km strike length. Its upcoming equity placement will be similarly tailored to the current market, said CEO Larry Phillips: "For the past five years of operations, Compass Gold has been very disciplined, making sure that we spend at least 90% of capital raised from our shareholders on the ground. There are four or five areas that warrant follow-up drilling, but the markets have been very tight this year, so we decided to focus more exclusively on a single area. Instead of raising C$3-4 million and diluting our stock, we turned to our shareholders to fund exploration on a particular area for six to eight months, before moving to the next. At the moment, we are looking to add about C$1.5 million in capital, which will see us through the drill program planned for the first six months of 2023." ■

Where are gold juniors listing in 2022?

LIBERIA-FOCUSED HAMAK GOLD

Why did you choose the London Stock Exchange over other exchanges for your 2022 IPO?

KARL SMITHSON, CEO: "Besides the fact that I am very familiar with London and I have worked with many brokers, analysts and corporate finance advisors, I think the London investor pool offers good access to capital for the right projects. Also, I believe institutional investors in the London market have a better understanding of African resources compared to Canadian and even Australian investors.

As the main shareholder, local business entrepreneur Amara Kamara owns 63% of the company, and the rest of the board makes up another 12%. With 75% of the company held by directors, Hamak is a closely held stock, which is a challenge when it comes to raising capital. But as we grow, we will broaden the share register to bring in more entrants. Amara will probably dilute his share to allow a larger free float. Currently, we have specialist funds out of London and Germany on our register, together with the retail element."

MALI-FOCUSED TOUBANI RESOURCES

Can you comment on Toubani Resources' reasons for seeking a dual listing on the ASX in 2022?

DANNY CALLOW, PRESIDENT AND CEO: "Over the past 18 months and with our most recent raises, it has become very apparent that our biggest support came from Australian investors, but many investors did not have access to our shares since we were listed in Toronto. With our major shareholders being Australian based, we decided to look for a dual listing in Australia, which was formally accepted at the end of November. In conjunction with the listing, we completed a capital raising of A$6 million, letting in a broad base of predominantly Australian shareholders. The dual listing grants Toubani more exposure to funds and investors that are only able to invest in ASX-listed stocks, together with more volume for our stock and an opportunity to see an appreciation in the share price. Australian investors understand West Africa very well, and the success stories of Perseus, West African Resources (WAF), Firefinch, Tietto, Orezone, and other gold players prove that."

ETHIOPIA-FOCUSED AKOBO MINERALS

What are the advantages of trading on the Oslo Stock Exchange (OSE)? Will you be pursuing a secondary listing?

JØRGEN EVJEN, CEO: "Akobo Minerals was a private company, but since 2020, our mandate has been to professionalize the organization and list the company. Back in 2018, we wanted to list in Sweden because of the much larger mineral community there, but ended up going public in Norway where we have much greater visibility as one of only very few mining companies. Our shareholder base is centered around Trondheim in Norway, owning some 80% of the company. If we were to list in Toronto or Australia at this stage, we would become one of maybe 1,000+ juniors competing for the same attention. That said, in the future we are considering a dual listing to bring in more international investors and liquidity. The AIM, Nasdaq Stockholm or the Frankfurt exchange are our proffered options to reach a wider universe of investors."

Gold juniors and artisanal miners in West Africa

XTRA-GOLD RESOURCES IN GHANA

JAMES LONGSHORE, CO-FOUNDER AND CEO

"In 2010 we had serious issues with illegal miners encroaching on our properties. We reached out to them and completed the first-ever alluvial gold mining agreement in Africa, at least to our knowledge. With the funds generated from selling the bullion from the alluvial operations, we are financing our hard rock exploration. Admittedly, this arrangement was settled at a time when illegal dealing was not as rampant as it has become today across West Africa. Once artisanal mining gets entangled with criminal activities, it becomes much more difficult to stop. Also, setting up such a model is not easy. When we did it, I lived in Ghana for a couple of years straight. This year, the Ghanaian government tried to charge artisanal minerals a 3% withholding tax, later reduced to 1.5%, but this measure had the opposite effect, resulting in more illegal exports. In my view, the key challenge is the chronic lack of trust in the system. This makes artisanal mining very challenging to regulate."

HAMAK GOLD IN LIBERIA

KARL SMITHSON, CEO

"Artisanal gold mining is active across our licenses. The locations dug by artisanal miners have become our pathfinder on the ground. At Gozohn, we did about 4,000 geochem soil samples on these areas and found an anomaly that stretched over 3 km. We backed this up with rock chip samples and found gold values of up to 3 g/t. We followed the same process at Nimba, again finding a soil anomaly of over 3 km long and 1 km wide, with high grades. After sampling an outcrop exposure actively pursued by artisanal miners, we retrieved 37 and 45 g/t Au grades. The width of the mineralization at surface seemed to be over 50 m based on further channel sampling over the area."

COMPASS GOLD IN MALI

LARRY PHILLIPS, CEO

"Interestingly, the presence of artisanal miners complements what we are doing because the presence of open-pit artisanal mining is one of the indicators used to determine the location of our drills. We have an all-Malian team on the ground, which also helps us establish good dynamics with locals. Also, Mali provides a legal framework to allow surface artisanal mining to coexist with companies that drill at greater depths."

Mark Bristow

PRESIDENT & CEO
BARRICK GOLD

How would you assess Barrick's performance in 2022

Barrick remains on track to achieve its 2022 gold production guidance at the lower end of the range. Our copper portfolio has performed well and is trending towards the midpoint of its guidance.

We are continuing to build our balance sheet, our dividend policy is delivering sustainable returns and we have shored up our life-of-mine plans to ensure that our 10-year production profile remains intact. Our successful exploration programs are feeding high-quality prospects into an already bulging pipeline and we expect to grow our reserves net of depletion again this year.

While Nevada is Barrick's value foundation, our Africa & Middle East region is our most consistent producer of excellent performances on all fronts, as well as a rich store of gold and copper growth opportunities. Barrick's status as Africa's biggest gold miner is underlined by the Loulo-Gounkoto complex, which routinely accounts for around 7% of Mali's GDP. It's been going strong for 18 years and its continued success in replacing depleted reserves gives it a lease on life of at least another 10. Kibali, Africa's largest gold mine, produced another steady performance with improved costs across all metrics. Hydropower provides most of the mine's energy requirements, offsetting the impact of higher diesel prices. Our Tanzanian operations are a great example of partnership in action. When we took over North Mara and Bulyanhulu they were not only badly run down but effectively closed. We settled their legacy issues in a joint-venture deal with the government and transformed them into new mines capable of a combined annual production in excess of 500,000 oz.

What potential does Barrick sees in the Nubian and Arabian Shields in North Africa?

We have filters for going into new countries with geological prospectivity being the number one priority. In Egypt, we were awarded four exploration licenses for 19 blocks, covering a total area of 2,900 km² in the highly prospective Eastern Desert region of the country. The Eastern Desert is part of the Proterozoic Arabian Nubian Shield, which hosts the giant Sukari deposit and numerous other gold occurrences, but which has seen no recent systematic exploration. We intend to work closely with the Egyptian Mineral Resource Authority (EMRA) and other participating exploration and mining companies, to finalize the terms of Egypt's exploitation license agreement which will apply to the industry. The move into Egypt is an integral part of Barrick's exploration strategy. ■

Nico Muller

CEO
IMPALA PLATINUM (IMPLATS)

Could you give us a brief overview of Implats' performance over the past year?

Implats delivered robust earnings and free cash flow generation for its half year ended 31 December 2021. The Group maintained a strong and flexible balance sheet while pursuing value-accretive organic and acquisitive growth.

What are the key operational milestones at your African assets?

Implats has committed close to R50 billion to its capital investment programme over the next five years.

Southern Africa is the world's largest source of primary platinum group metals supply, and Implats' investment in increased beneficiation capacity and extended life-of mine development at several of our operations will position the country more competitively as a global mine-to-market PGM producer.

Implats has committed up to R12 billion to expand Group processing facilities located in Southern Africa over the next five years. An initial US$521 million (R8.2 billion) will be invested in the expansion of existing Zimbabwean smelting capacity and the construction of an SO2 abatement plant to mitigate air quality impacts. Access to hydropower, supplemented by electricity provided by a 35 MW solar plant, which will be expanded to 185 MW in a phased approach, will result in an industry-leading environmental footprint for the Zimbabwean smelting facilities.

Implats will invest another R4.4 billion into improving its South African processing facilities. Circa R500 million has already been approved to expand treatment capacity by 10% in the medium term at its base metal refining facilities in Springs. In addition, feasibility studies into further capacity expansions at both its South African base and precious metals refineries are well advanced.

Implats will also invest more than circa R8 billion across its South African mining operations over the next few years (including attributable capital at its joint ventures). This investment will extend the life-of-mine at existing producing mines. ■

Sébastien de Montessus

PRESIDENT & CEO
ENDEAVOUR MINING

With seven mines across three countries, and record annual discoveries in 2021, how do you envision Endeavour's asset portfolio in five years' time?

We remain focused on growing the company organically through exploration and developing the assets we have. In particular, the Sabodala-Massawa expansion project in Senegal, which will expand the processing capabilities and ultimately boost production, is progressing well and on budget and on schedule. Regarding greenfield projects, the DFS for the Lafigué development project in Côte d'Ivoire is due to be published in Q3-2022. On the exploration side, last year, we announced our goal to discover between 15 and 20 million oz Au by 2026. We are making good progress towards this goal with over 250,000 m drilled already this year.

Could you highlight the key takeaways from the Sabodala-Massawa DFS?

The DFS for Phase 2, which was published in April 2022, recommended the expansion of the Sabodala-Massawa complex by supplementing the current 4.2 million t/y Carbon-in-leach ("CIL") plant with a 1.2 million t/y BIOX® plant to process the high-grade refractory ores from the Massawa Central Zone and Massawa North Zone deposits. Construction of Phase 2 expansion began in Q2-2022 with first production from the new BIOX® plant expected in early 2024.

Endeavour launched its new ESG strategy in June 2021. Could you explain your approach to ESG?

A good example of this is the Endeavour Foundation, which we created last year to be our primary vehicle for implementing ESG projects. The Foundation is currently working on a variety of initiatives in education, environmental protection and health.

We are also working to protect the environment and mitigate any negative impacts from operations. Our ultimate ambition is to be Net Zero by 2050 and, in the interim, achieve a 30% reduction in emissions intensity by 2030 for Scope 1 and 2 emissions.

We have identified solar power projects at our Houndé and Sabodala-Massawa mines and are currently evaluating the potential for more renewable energy opportunities across our assets. ■

Peter Steenkamp

CEO
HARMONY GOLD

What have been the most important recent milestones and developments at Harmony?

H1 FY22 production saw a 4% increase to 778,879 oz, and H1 FY22 revenue increased by 2% to US$1.5 billion. H1 FY22 net profit decreased by 69% to US$96 million.

Construction of Phase 1 of our renewable energy programme is now underway. This project will deliver 30 MW of renewable solar PV energy to our Free State operations once complete. We have secured a R1.5 billion green loan which will be used to construct Phase 2 of our renewable energy rollout, delivering a further 137 MW to our operations. This is an important step in our journey to decarbonise and achieve our goal of net carbon zero by 2045.

What does Harmony's future pipeline look like?

Greenfield exploration projects include Wafi-Golpu in Papua New Guinea and Kalgold and Target North in South Africa. These complement the various brownfield projects currently underway such as the Zaaiplaats expansion at the Moab Khotsong underground mine and the expansion of the Kareerand tailings dam at Mine Waste Solutions, a surface retreatment operation. Diversification through M&A is something that would have to be done carefully and with good timing and planning.

Do you have a final message?

Harmony in a strong position to continue delivering operationally, creating further value for all our stakeholders. Our de-risked and diversified portfolio continues to perform as expected, and we are optimistic about the future prospects in both South Africa and Papua New Guinea. We have a duty to keep sustainability at the centre of all strategic decisions. This means delivering meaningful returns to our shareholders while at the same time effecting positive change and maintaining the trust of all of our stakeholders. Harmony is more than just mining. We are in the business of converting resources into value and this extends to our shareholders and, indeed, all our other stakeholders. ■

Clive Johnson

PRESIDENT AND CEO
B2GOLD

Can you comment on your portfolio strategy?

We continually review our asset portfolio with a view to adding high value exploration opportunities and disposing of assets that do not meet our investment criteria. The Oklo Resources acquisition, completed in September 2022, provides B2Gold with an additional landholding of 1,405 km^2 covering highly prospective greenstone belts in Mali, including Oklo's flagship Dandoko project, which has an existing mineral resource estimate of more than 600,000 oz Au. In addition, in 2022 we acquired the highly prospective Bakolobi permit, which is contiguous to the Menankoto permit and joins the Anaconda area to the Medinandi permit (which hosts the Fekola mine).

In Burkina Faso, B2Gold's sold its 81% interest in the Kiaka gold project to West African Resources (WAF) at the end of 2021. B2Gold also completed the sale of its 90% interest in the Toega gold project to WAF.

Fekola is now in its fifth year of production, can you update our audience on its performance?

In 2022, Fekola was expected to produce around 600,000 oz at an AISC of US$840-US$880/oz, and we expect to be at or near the higher end of the production guidance range.

Could you comment on B2Gold's exploration budget for 2022?

After a very successful exploration year in 2021, B2Gold again conducted an aggressive exploration campaign in 2022 with a revised budget of approximately US$75 million. Exploration has focused predominantly on Mali, as well as other operating mine sites in Namibia and the Philippines, with a continued focus on grassroots targets.

Do you have a final message to share with our audience?

We remain in a strong net positive cash position with approximately US$550 million in cash and cash equivalents as of September 30, 2022, and paid a third quarter dividend of US$0.04 per common share (annualized rate of $0.16 per common share), representing a 5.0% yield as of September 30, 2022. B2Gold will continue to maximize profitable production from its mines, further advance its pipeline of development and exploration projects, evaluate new exploration, development and production opportunities and continue to pay an industry-leading dividend. ■

Terry Holohan

CEO
RESOLUTE MINING

Could you elaborate on the work done at the Syama processing plant & mine?

For the past four or five years, Resolute had focused on identifying more oxides, which are easier to recover, whereas sulphides are the long-term future of the mine.

While in the past Resolute had bought into explorers like Loncor Gold or Oklo Resources to secure its growth pipeline, we have now decided to spend the majority of our investment monies on brownfields and greenfields exploration where we are seeing immediate success. We have an 85 km strike in a prolific area full of artisanal miners, whom we don't see as a problem, but as sort of geochemists. For the first time since the 1990s, we ran an aeromagnetic survey over the tenements and are now bringing in structural geologists to identify key targets. From the last 120 drills we hit gold 120 times and have delineated a shallow maiden resource of 20 million tons at 3.1g/t for 2 million oz. This could be a game changer for our operations.

Syama is a huge project, with over 7 million oz of gold in the ground, but the production is quite small, at 220,000 oz/y. We plan to double, if not triple, the size of the operation over the next five years.

What is your strategy for controlling costs in an inflationary environment?

For years, Resolute had been fighting to fix the revenue side of the equation, focusing on the tons, grade and recovery while neglecting costs. Now that we are ticking the boxes on revenue, we have started to systematically trim down costs. Fixed costs are quite high, but we have taken various measures to optimize our overheads. For instance, we have been promoting skilled locals, we have automated the reagent additions process, reduced our Perth office footprint, and relocated some of our employees to London, such as myself, so they can work in the same time zone as West Africa. ■

Jeff Quartermaine

CEO
PERSEUS MINING

Could you share the latest operational developments at Perseus Mining?

We achieved our target of producing half a million ounces (oz) of gold at a margin of US$732/oz that was almost double the target of US$400/oz we had set. On the ground, we turned Yaouré – Perseus' third mine that poured first gold in December 2020 – into a powerhouse of the business, currently producing between 50% and 60% of total gold output at a low AISC, with margins above US$1,000/oz. We believe that mineralised structures identified near the Yaouré open pit should allow us to extend the life of the mine well beyond the current decade. Sissingué, our first mine in Cote d'Ivoire, has been punching above its weight from day one, while Edikan, our mine in Ghana, has been a steady producer for us. This September, Edikan reached its 2 million oz mark just as the mine wrapped up its 10th year of production.

What has motivated the acquisition of Orca Gold in 2022?

Some people were surprised by the move because of geopolitical challenges in the past and the fact that there are no other large foreign mining companies operating in the country. With the acquisition, Perseus put at risk of about 9 to 10% of our company and in return, we doubled our ore reserve inventory, added a 15-year mine life project to our portfolio, and, very importantly, we secured a first-mover advantage in one of the most underexplored and apparently well-endowed mineral precincts in the world. With the experience of bringing onstream three mines in the last decade, we are confident we possess the inhouse technical expertise to develop the Block 14 gold project in Sudan into a producing mine.

Could you comment on your performance on the ASX over the past year?

We were recognized in the TSX 30 (top 30 performers) for the last three years. We set ourselves a clear strategy to build the company and have done everything we set out to do. ■

Jorge Ganoza

CEO
FORTUNA SILVER MINES

What have been the main developments at Fortuna Silver Mines over the past year?

The catalyst for value at Fortuna is the development of the Séguéla gold project in Ivory Coast. We made a construction decision in the third quarter of last year, and we are now 78% complete as of the end of September.

How has your construction budget and projected costs evolved in the past year in light of inflation?

Our construction budget at the beginning of 2021 was around US$145 million. By the time we made the construction decision in September, we had increased the construction budget to US$173 million. We were able to prepare, plan, and guide our teams in a way that our budget didn't deviate financially and timewise.

How has the political instability in Burkina Faso impacted Fortuna Silver Mines?

Our view is that mining is a frontier business. We need to have a high tolerance for challenging environments. There is certainly political instability in the region, particularly in Burkina Faso, but despite the volatile changes in government and the immature political processes, the continued support for responsible mining in the jurisdiction is quite notable. Governments come and go, and sometimes the political process is interrupted by insurrections, but the continued support for responsible mining remains. We were surprised by the abrupt transition of government in Burkina Faso, but we were rapidly approached by the new authorities, who were trying to ensure the continuity of business.

Can you summarize your top priorities for the following year?

Our priority is to complete the development of Séguéla until the mine is fully commissioned by mid-2023. At the same time, we continue expanding our resources and we are exploring aggressively with positive results. Earlier in the year, we published the maiden inferred resource at Sunbird, a new deposit within the Séguéla complex, of 350,000 ounces comprised of 3.4 million t averaging 3.16 g/t gold. ■

James Longshore

CO-FOUNDER AND CEO
XTRA-GOLD RESOURCES

Could you introduce Xtra-Gold Resources to our international audience?
We acquired the Kibi gold project property in 2003 and received the government grants and licenses three years later. The Kibi Gold Belt where our project is located had never seen prior exploration before we came in, despite being known for having one of the richest sources of alluvial gold in West Africa, as most explorers focused on the Ashanti belt next door. Kubi has the potential to deliver significant deposits. So far, we have only drilled about 2% of our 226 km^2 land tenure. Based on our internal models, the resource is exceeding 1 million oz, but our goal is to push it to 2 million oz in the next 18 to 24 months. We are aggressively drilling using our own equipment – we own 3 drill rigs that run 24/7, saving 80% of drilling costs.

Why has Ghana has failed to attract much greenfield explorers compared to its neighbours?
As a mature mining district with some of the oldest-known greenstone belts, Ghana has already delivered all the low-hanging fruits. Kibi is the only underexplored belt, of which we own about 70%. Also, with only nine large producers, the mining sector generates the largest source of foreign reserves for the government, who takes more than 50% of every net dollar. While this may be workable for producers during a boom period, juniors cannot afford the same level of taxation. The problem is that the government treats mining and exploration in a very similar fashion. With VAT added on everything from drilling to assays and other expenses, the barrier to entry becomes insurmountable for juniors. Therefore, many Canadians and Australian explorers moved to Ivory Coast, Burkina Faso or Mali, choosing higher political risk over higher taxation. There are only three explorers left in Ghana. Every year, we hear pledges about tax cuts, but this has not happened yet. Instead, the government is more focused on lowering barriers for bauxite and lithium ■

Jørgen Evjen

CEO
AKOBO MINERALS

Could you introduce Akobo Minerals to our audience?
About 12 years ago, we started then-called Abyssinia Resources Development, a Norwegian-Ethiopian JV company, with a view to starting a small gold operation in the vicinity of the Akobo River in Ethiopia. Close to the South Sudanese border, this extremely remote area was never mined before and lacked all basic infrastructure. Setting up the logistics and getting in supplies was incredibly difficult, but we carried on with trenching, soil sampling, and RC drilling to build our geological model. In 2019, we did our first core drilling and struck a bonanza-grade gold deposit unlike anything else seen before.

Can you familiarize our audience with the two deposits and your strategy for developing these?
Within the 182 km^2 exploration landholding, the mining license covers the Segele discovery stretching over 16 km^2. Segele is the first discovery made and an outstandingly rich deposit: It is a petite mine of incredibly high grades with an average of 22.7 g/t Au in the Resource estimate, and 40.6 g/t in Indicated resources. The deposit is open at depth, and we are confident to find similar shoots around it. The second area is called Joru and has a very different geology, with more of a traditional lower-grade mineralization but with the potential for larger volumes. Segele gives us the opportunity to move into production quickly, while we inject cash into developing Joru and other targets. With all technical studies completed and the mining license received, Segele is on track to start production in beginning of 2023. The cash generated at Segele will help us fund ongoing exploration for many years ahead.

What is the capital you require to bring Segele into production?

According to our scoping study, we were looking at a CAPEX of approximately US$10 million to get the mine up and running, way below the standard capital requirement of most development projects. We estimate that Segele will generate US$50 million of free cash flow over the next 2 years. ■

Karl Smithson

CEO
HAMAK GOLD

What led to the creation of Hamak Gold this year?
As a director at Newfield Resources, an Australian company developing an underground diamond mine in Sierra Leone, we entered a JV with local business entrepreneur Amara Kamara. Amara held 10 licenses throughout Liberia, and was looking for an experienced partner to unlock the potential of these licenses. He and I put together a package of gold exploration licenses and founded Hamak Gold. We brought in a board of directors and appointed London-based advisory groups to try to list on the London Stock Exchange. Our work culminated with the IPO of Hamak Gold in March this year, through which we raised £1 million.

Can you walk us through the exploration work done to date at your two licenses, Nimba and Gozohn?
At Gozohn, we did about 4,000 geochem soil samples and found an anomaly that stretched over 3 km. We backed this up with rock chip samples. We followed the same process at Nimba, again finding a soil anomaly of over 3 km long and 1 km wide, with high grades. After sampling an outcrop exposure actively pursued by artisanal miners, we retrieved 45 g/t Au grades. At this point, we wanted to have a couple of drill holes under our belt before going to the markets. The first drill hole came back with 7 g/t over 20 m, within which we have 5 meters grading at 22 g/t and individual intersections of 40 g/t, which suggests mineable grades in an open pit. The next step is to define more detailed targets for the next drilling program starting next year.

How has Liberia evolved as a mining jurisdiction?
Both the geology and the governance tick the box, and we have a mining minister who is very accommodating of juniors and tries to stimulate the exploration sector. Taxation is fair and royalties are generous compared to Liberia's peers in the region, but logistics are a challenge. ■

Stephen Mullowney

CEO
TRX GOLD

Tanzanian Gold Corp. recently rebranded to TRX Gold Corporation. Could you introduce the company?
Together with our JV partners, the State Mining Corporation of Tanzania (STAMICO), TRX Gold is developing the Buckreef gold project, a 2 million oz Measured and Indicated gold resource deposit with an average grade of 1.8 g/t Au. We have started by mining out the oxides, which represent about 10% of the resource, at the same time as we are developing the remaining 90% found in sulfides. Our immediate goal is to roll out the small production operation and reinvest the cash flow that is generated to develop the full project. In the last quarter, we achieved production of 2,733 oz. The company's rebranding came together with a new executive team and a fresh vision.

Could you elaborate on TRX's strategy of moving Buckreef quickly into production?
We put the mine into production in less than nine months, and the capital invested had a very quick payback, of under three months. Currently, the oxide plant has a capacity of 360 t/d and produces over 1,000 oz/month at a very low cost – just over US$500/oz in the last quarter. We plan to grow it to 20,000 oz/month for the first couple of years, depending on the grade profiles we put through the mill.

How do you see Tanzania's future in terms of attracting exploration dollars in the gold space?
Tanzania scores much better than other jurisdictions, primarily thanks to the availability of talents and a well-established service sector. Politically and regulatory-wise, the country is also moving in the right direction. The government wants to grow the contribution of mining from 5% to 25% of GDP by 2025. TRX has had good government relations and the communication has been straightforward for getting our permits.

Do you have a few final words?
TRX is focused on growth and more growth. We want to see the plant up and running at a capacity of 1,000 tons/day in the next quarter, and then gradually grow our reserves and resources through intensive drilling. ■

Battery Metals

The African rush to lithium

> *Rather than throwing the lithium away as we have been doing to date, we are now looking to extract it as a by-product to the extent that we become a lithium mine with a tin by-product.*
>
> **Anthony Richard Viljoen**
> **CEO, AfriTin Mining**

MAIN COUNTRIES:

- **Cobalt**: DRC (biggest in the world)
- **Lithium**: Zimbabwe, DRC, Ghana, Mali, Namibia, Zimbabwe
- **Tantalum**: DRC (biggest in the world); (Other) Rwanda, Nigeria
- **Nickel**: South Africa, Madagascar, Ivory Coast, Zimbabwe, Namibia
- **Vanadium**: South Africa
- **Manganese**: South Africa (biggest in the world), Gabon, Ghana
- **Graphite**: Madagascar, Mozambique, Namibia, Tanzania, Zimbabwe

The African rush to lithium

Africa's contribution to the EV revolution has so far been mostly reduced to the controversy of DRC's cobalt, the world's biggest, most coveted, but also most contested cobalt resource, due to its links to child labor and illicit trading. While the mining industry in the Congo fights to prove good practices and disentangle its operations from the prejudice surrounding the blue metal, a paradigm discussed elsewhere in this book (see article at page 46), lithium is causing a stir in the African mining space: "In my 20 years of experience, I have never seen such a crazy rush for a metal," said Anthony Viljoen, the CEO of AfriTin Mining, a tin producer and emerging lithium producer in Namibia.

AfriTin was spun out of Bushveld Minerals, one of the largest vanadium producers in South Africa, back in 2017. For the past five years, AfriTin has mined tin from the Uis mine in Namibia, but it is now looking to adapt its production circuit to also extract the lithium that currently reports as waste at its operation. A modular expansion of the current circuit will allow AfriTin to segregate and commercialize lithium concentrate, while a magnetic separator will identify the tantalum. Because the mine is already in production, AfriTin is ahead of the market, ready to begin lithium production by Q2 of next year.

AfriTin is not the only miner that was throwing away lithium in Africa. The continent contains lithium pegmatite deposits which are typically bound up in a range of ore minerals, including pollucite (mined for caesium), columbite-tantalite (tantalum), and cassiterite (tin). Indeed, the only lithium-producing mine in Africa is Bikita, a former tin mine discovered more than 100 years ago in Zimbabwe. However, Bikita mostly produces petalite concentrate sold for glass and ceramics, even though it does contain spodumene pegmatites, the most important ore used in lithium batteries.

Lithium prices more than tripled over the last year. In China, lithium carbonate prices touched a new record in October this year, trading at an all-time high of US$74,475/t. Despite a looming economic depression, demand for EVs is expected to grow sixfold by 2030, according to Bernstein Research. Bloomberg reports that EV cars may represent 40% of all cars by 2030. Today, 10% of all cars on the road contain batteries. The supply shortage for lithium, but also cobalt, nickel, tantalum and vanadium, is a reality for the battery value chain, including the mining industry. The value deal of critical minerals transactions grew by 159% since 2019, according to a recent report by PwC, which expects further M&A in this space. Because of the typically small and niche size of such deposits, these transactions are more likely to involve mid-tiers and juniors rather than major mining companies.

Except for the Bikita mine in Zimbabwe, Africa has no other active lithium mines, but multiple projects in development are racing to change that. Also in Zimbabwe, Prospect Resources is developing the Arcadia lithium mine, which it recently sold in 2022 to Zhejiang Huayou Cobalt. Other greenfield projects are being developed in Mali, namely the fully funded Goulamina project developed by Leo Lithium as part of a JV with Jiangxi Ganfeng Lithium, which is due to start production in 2024, and the Bougouni project by Kodal Minerals, which is yet to be funded. Ghana also has a promising lithium project with Ewoyaa, of Atlantic Lithium, also funded through to production. Ewoyaa contains 30.1 million t at 1.26% Li_2O. While advancing Ewoyaa through the permitting process, Atlantic Lithium has also applied for exploration licenses in Ivory Coast: "At the time of securing our Ghanaian licenses, we completed a top-down review of the West African Birimian Belt, a geological domain that is proven to be prospective for lithium. Currently, the focus on gold exploration, logistics and technical challenges due to higher rainfall and vegetation cover, have generally left West Africa underexplored for lithium. We currently hold two lithium applications in Cote d'Ivoire, and we are assessing strategic opportunities to grow our portfolio in the region, whilst we continue to grow organically in Ghana. Just like Canada and Australia, which share similar geology terrains and are delivering significant lithium discoveries, we believe West Africa will deliver the same," said Len Kolff, the Interim CEO.

The DRC has the largest lithium pegmatite corridors. Tantalex Lithium Resources is developing a greenfield exploration project called the Southwest Pegmatite Corridor: "We have done geochemical work together with a 100 km²

LITHIUM PERFORMANCE: STEEPLY UPHILL
Source: Trading Economics

CURRENT LITHIUM PROJECTS IN AFRICA
Source: GBR, British Geological Survey

Developer	Project Name	Country	Stage
Atlantic Lithium	Ewoyaa	Ghana	Funded, PFS completed, started permitting
Premier African	Zulu	Zimbabwe	Pilot plant funded and under construction
Tantalex Lithium Resources	Manono Tailings	DRC	MRE and PEA by the end of 2022
Afritin Mining	Uis	Namibia	Production of first concentrate by Q2 2023
Lepidico	Karibib	Namibia	Construction started with a goal to start production in 2025; offtakes signed
Leo Lithium	Goulamina	Mali	Fully funded and under construction
Zhejiang Huayou Cobalt	Arcadia	Zimbabwe	Production in Q1 2023
Zimbabwe Lithium & ZLC	Kamativi	Zimbabwe	NI 43-101 published and currently proceeding through judicial process
AVZ Minerals	Manono	DRC	Funded, DFS completed, Mining license awarded in Q3 2022
Kodal Minerals	Bougouni	Mali	Planning for construction, pending funding

> *Just like Canada and Australia, which share a similar geology and are delivering significant lithium discoveries, we believe West Africa will deliver the same.*
>
> **Len Kolff**
> **Interim CEO, Atlantic Lithium**

Image courtesy of Lepidico.

high-res aeromagnetic survey, and we are planning roughly 20,000 m combined RC and DD drilling. The drilling program has started and we are hopeful for positive results by the end of Q4 2022," said Hadley Natus, the chairman of Tantalex.

But the projects closest to production are brownfield mines where tin had been mined in the past, disregarding the lithium component. Today, the lithium content is reason enough to restart these historic mines. Owned by AVZ Minerals and two local companies, the Manono project in the DRC contains one of the world's largest LCT (lithium, caesium, tantalum) resources. Manono had been mined in the past for tin, but AVZ released a compelling DFS in 2020 reporting a resource of 401 million t at 1/65% Li2O spodumene, which would give the lithium operation a production life of almost 30 years. Tantalex also has a license on the historic tailings of Manono and is preparing to put out a mineral resource estimate by the end of 2022.

Almost every lithium project developed today in Africa has secured at least part of the pre-production funding, typically through off-take agreements, which speaks of the market's hunger for lithium minerals, especially spodumene. With Suzhou TA&A providing US$34.6 million for the construction and commissioning of a large-scale pilot plant, Zimbabwe-based Premier African Minerals is preparing to produce spodumene concentrate (SC6) in Q1 2023 from its flagship Zulu property. Premier committed 100% of the spodumene production at Zulu to CAMAX for the duration of the initial pilot plant operation, which is expected to be 3 years, but the operator maintains 50% of off take rights to all spodumene at Zulu beyond the life of the pilot plant. "The quicker we see more investment in Zimbabwe, the quicker the conversion of concentrates like spodumene into a carbonate or a hydroxide will take place in the country. There is a lot of talk about building conversion facilities in the UK and Europe, but it is not clear where the Spodumene will come from. I do not know when we will get to a stage where we will no longer expect African countries to simply export unprocessed raw materials to other markets that will enhance their value. This must change," said George Roach, the CEO of Premier.

The African mining industry has the perfect opportunity to participate in higher-end value chains instead of exporting raw materials. Whereas most African lithium projects are planning to produce hard-rock lithium concentrate and export it to third-party convertors, at the Karibib lithium project in Namibia, Lepidico is devising a vertically integrated business model to convert its lithium concentrate into lithium hydroxide and lithium carbonate at a chemical plant in Abu Dhabi. "Being vertically integrated means we can participate in revenue strength through the cycle, whether the pendulum swings in favor of concentrates or in favor of chemicals," said Joe Walsh, the managing director of Lepidico.

Lepidico entered a binding offtake agreement with multi-billion European company Traxys to sell all of its lithium hydroxide monohydrate for the first seven years of operation. The 35,000 t of African product will feed the EV supply chain.

The urgency of demand

Pick any car brand; each has an EV plan for the next 10 years and beyond. According to a review by Forbes Wheels published last year, 2030 should be the year when BMW will generate half of its sales from EVs, all Jaguar cars will be available in a battery version, and Volvo will only make electric cars. The investments that go together with these ambitions are equally grand. Volkswagen alone should put US$86 billion into EV investments through 2025. These automakers are not just throwing money on consumer demand projections but are aligning with regulators. 30 governments said they would ban the sale of new internal combustion (IC) engines by 2040 at the last COP26 talks. The entire value chain is reacting. 4062 MWh Gigafactory global capacity is theorized to become available by 2030, nearly four times more than the current capacity (1148 MWh), according to GlobalData.

So where will all the lithium come from to feed this demand? Sitting at the very upstream of the battery value chain, the mining industry cannot reply with certainty. A single EV car contains 8 kg of lithium. The IEA divided the lithium production by the amount needed per battery and found that, last year, the world will need 2 billion electric, plug-in hybrid, and fuel-cell EVs on the road by 2050 under the "Net Zero" roadmap. Current global reserves are sufficient to produce about 2.5 billion batteries, but not all reserves will be spent on EV batteries, since lithium is also required in the production of other items, like laptops or planes.

Also, while theoretically sufficient to meet demand, not all lithium reserves will be realistically brought into production, and not all deposits can produce high-purity lithium chemical products for batteries. Zulu Lithium, the project developed by Premier African Minerals in Zimbabwe, appears to contain mostly spodumene, said George Roach, Premier's CEO, but other African deposits are mostly lepidolite, the most abundant lithium-bearing element. Whereas spodumene is a direct source of lithium hydroxide or carbonate through a chemical process, lepidolite needs to undergo an additional conversion process to extract lithium chemicals.

> *There is a real disconnect between lead times in upstream mining and processing and the downstream. Lead times for new mining operations tend to be 6 to 10 years, compared with 18 months to 2 years to build a new cathode or battery plant.*
>
> **Joe Walsh**
> **Managing Director, Lepidico**

The other challenge is the long lead time to production. It took an average of 16.5 years to develop lithium mines that started operations between 2010 and 2019, according to an IEA report. Joe Walsh, managing director of lithium developer Lepidico, speaks of the disconnect between lead times in upstream mining and processing and the downstream: "The US government's Department of Energy is forecasting annual lithium demand to exceed 3 million t by 2030, approximately six times 2021 demand. The reality is that the mining industry is unlikely to be able to supply anywhere close to this level of demand, in large part due to permitting and approvals challenges and headwinds from E&S compliance, to name a few. Lead times for new mining operations tend to be 6 to 10 years, compared with 18 months to 2 years to build a new cathode or battery plant," he said.

With 60% of global lithium chemical production and 80% of lithium hydroxide output, China unquestionably dominates the market. "China is light-years ahead, with the biggest conversion capacity to turn lithium concentrate into batteries and they are getting their hands on as many lithium projects as possible. The West is waking up to the fact that the whole car manufacturing industrial complex is at risk of being outsourced to China," said Anthony Viljoen, the CEO of AfriTin Mining.

China does not only have a clear advantage in lithium-ion batteries, but also for vanadium redox flow batteries, a growing alternative. After China, Russia is the second largest vanadium producer globally. The growing appetite for vanadium in China, together with pressures on the supply of Russian vanadium, are making room for a geopolitically neutral supplier like South Africa, reckons Jurie Wessels, chairman of Vanadium Resources, the developer of the Steelpoortdrift vanadium project in South Africa. Vanadium Resources has recently published a DFS showing the project could produce 12,000 t/y of vanadium pentoxide (or vanadium flake). Though mostly used in the steel industry, the main growth driver for the vanadium flake will be the battery market, according to Wessels: "With close to 180 years of life potential, Steelpoortdrift is such a compellingly large and financially robust project that there is no reason why it should not become the next major producing vanadium mine in the world," he said.

The dependence on China creates another layer of urgency for battery metals developers in Africa who see an opportunity to create alternative supply chains outside of China. Some mining companies are exclusively focusing on extracting battery-grade materials. In Botswana, Giyani Metals is targeting high-purity manganese sulfate at its K.Hill project. By skipping the production of metal as an intermediary step and going straight from ore to sulfate, Giyani can save both costs and CO2 and thus becomes competitive against China. China dominates 95% of the high-purity manganese sulphate industries, used in different types of cathodes for lithium-ion batteries. Only a few non-Chinese companies are developing the technology at a commercial scale, and only four listed companies are currently advancing manganese sulfate projects: "The high-purity manganese sulfate has not traditionally been a big market. But now, with the enormous demand coming from the EV industry, suddenly these minority markets like nickel sulfate, cobalt sulfate, lithium hydroxide and lithium carbonate are exploding. The high purity sulfate market is expected to run into a deficit of close to one million t by 2035. With China's tight grip on this market and the tidal wave of demand, sulfate supply is imbalanced and there is a clear need for new players to come in and help OEMs diversify their supply chains," said George Donne, VP business development at Giyani Metals. ■

Anthony Richard Viljoen

CEO

AFRITIN MINING

Could you introduce AfriTin to our international audience?

AfriTin was spun off from Bushveld Minerals in 2017. Thereafter, we restarted the old Uis tin mine, once one of the largest hard rock open-cast tin mines in the world, expanding tin production to 804 t/y of tin concentrate. Together with the mine development, we confirmed historic resources and reserves not only associated with the largest open-cast hard rock tin mine in the world but also the largest hard rock open-cast lithium deposit globally. Rather than throwing the lithium away as we have been doing to date, we are now looking to extract it as a by-product to the extent that we become a lithium mine with a tin by-product. We identified 71.54 million t inferred resources containing 450,265 t Li_2O at 0.63% grade, with significant unexplored pegmatite potential.

We will separate the lithium concentrate by adding a module to our production circuit, and the tantalum concentrate by adding a magnetic separator at the end of the circuit. Everything is well configured so that we will be producing tin, lithium, but also tantalum, effectively developing three revenue streams from the same ore body. We expect to produce our first run of the lithium concentrate by Q2 2023.

Could you give us a sense of your ESG agenda in the area?

First, we are very cognizant of the need to protect the sensitive flora and fauna in our environment, and we support multiple initiatives, including ranger sponsorship for the lions, elephants, and rhinos roaming in the area. From a social point of view, when the Uis mine stopped producing in the late 1980s, poverty crept into the region. People don't always realize the multiplier socio-economic effects of mining, but we are doing our best to support the local communities. AfriTin is involved in local education for all ages. Finally, most of our staff are locals, and 60% of the management of the mine are women. AfriTin is pioneering new-age mining, with a clear and purposeful ESG focus. ■

Joe Walsh

MANAGING DIRECTOR

LEPIDICO

Could you summarize the key developments at your Karibib project over the past year?

We have been prioritizing three main workstreams: The first is a binding offtake for our lithium product from our Phase 1 project together with offtake arrangements for the other products. We entered a binding offtake agreement with European trading company Traxys for effectively all of our lithium hydroxide monohydrate produced over the first seven years of operation – that is 5,000 t/y of product that we envisage will go into the electric vehicle supply chain. The second has been financing, both debt and equity, which includes a strategic partner initiative, and the third has been completing the front-end engineering and design work with our EPCM contractor, Lycopodium, to build the concentrator in Namibia and the chemical plant in Abu Dhabi. We are fully permitted and shovel-ready in Namibia, so once we close out these workstreams, we will be moving into construction with a view to starting production in 2025.

What are the advantages of your vertically integrated model of operation, from mine to chemicals?

Being vertically integrated means we can participate revenue strength through the cycle, whether the pendulum swings in favor of concentrates or in favor of chemicals. Lepidico will also benefit from revenue diversification from by-products because our process technologies basically de-constitute the lithium mica mineral into six product streams with no solid process waste: the lithium reports out as (1) lithium hydroxide, (2) cesium and (3) rubidium report as sulfates, (4) potassium as SOP fertilizer, and the residues are a highly reactive (5) amorphous silica, and a (6) gypsum rich material. Along with having low energy intensity, this provides our Phase 1 Project with excellent environmental credentials. ■

Hadley Natus

CHAIRMAN

TANTALEX LITHIUM RESOURCES CORP

Could you share the highlights of your Mineral Resource Estimate (MRE) at the Manono tailings project?

Our Maiden Resource Estimate indicates a Total combined Resource of 12,090 million t with an average grade of 0,64% Li_2O, with half of this in the Measured and indicated Category. This MRE is taken from 13,000 m of drilling on approximately half of the total volume of the dumps and tailings from the historical mine.

What are the next steps now on the Manono project?

Our major competitive advantage compared to other developing peers is speed to market and low cost mining. Our resource is sitting on surface already crushed and ready to be transported to a process plant to produce 6% Li_2O spodumene concentrate (SC6). We have started additional testing to confirm the final process flowsheet and optimal recoveries.

We have already initiated a Pre-economic Assessment, and Social and Environmental Impact Assessments, so that by the end of Q2, 2023 we have completed our Feasibility Study on Initial plant slated to produce 100,000 t/y of SC6 for a period of 6-8 years.

Additionally, we have planned an extensive drilling campaign on the hard rock Pegmatite Corridor southwest from our tailings project as well as additional resource definition work on the tailings project with an objective to increase our overall resources in lithium, tin and tantalum. I believe there are more tailings products on the continent of Africa that can be brought back to life by reviewing existing data and going back on the ground to do further exploration and resource definition. Mining tailings is not only the cleanest form of mining but also the cheapest: Except for rehabilitation costs, mining costs are negligible.

Do you have a final message for our international audience?

Our mission statement going forward is premised on three goals: To get the Manono Tailings PFS out by Q2 2023; to see our TiTan project cashflow positive next year; and to create more value for our shareholders by finding the next big lithium resource in the Southwest Corridor. ■

Len Kolff

INTERIM CEO

ATLANTIC LITHIUM

What have been the latest developments at your flagship Ewoyaa lithium project in Ghana?

Atlantic Lithium has made excellent progress over the past few months. We put out a very positive resource upgrade, on the basis of which we then published a PFS with strong fundamentals and economics. This is on account of the project's simple mineralogy and resulting low CAPEX, and its access to operational infrastructure, including a sealed road, deep-sea port, electricity, and highly skilled personnel, providing for low OPEX in the pro-mining jurisdiction of Ghana. Following the PFS, we also started the permitting process by submitting our mining application.

Meanwhile, on the ground, we drilled a total of 47,000 m between March and October 2022. As part of this campaign, we published details of excellent intersections, both from an infill drilling perspective and from an exploration drilling outside the main footprint. We now expect to significantly de-risk the project by moving more material from Inferred to Indicated and to define Measured resources. However, we will also increase the total resource figure from the current 30.1 million t at 1.26% Li_2O.

Why has Atlantic Lithium rebranded?

The company (as IronRidge Resources) first listed on AIM through its IPO back in 2014. The Ewoyaa lithium grassroots discovery in Ghana has since dictated our focus on lithium, and we have since spun-out our gold assets and changed our name to Atlantic Lithium.

Could you speak to us about your broader portfolio strategy in West Africa?

At the time of securing our Ghanaian licenses, we completed a top-down review of the West African Birimian Belt, a geological domain that is proven to be prospective for lithium. We currently hold two lithium applications in Ivory Coast, and we are assessing strategic opportunities to grow our portfolio in the region, whilst we continue to grow organically in Ghana where we have only explored roughly 13 km^2 out of our 560 km^2 tenure. ■

Rare Earths

Looking for the best and rarest REE deposits

MAIN COUNTRIES:

South Africa, Angola, Namibia, Malawi, Uganda, Madagascar, Mozambique, Tanzania, Burundi, and others

> *Geopolitically, the appetite to develop a refinery and unlock the value of individual rare earths outside of China is very high, driven by Western governments ambitions with alternative, sustainable and traceable rare earth supply in the long-term.*
>
> **Tim Harrison**
> **MD & CEO, Ionic Rare Earths**

The rare earths elements (REE) market has always represented a niche part of the mining industry, restricted to a limited number of players and to China. Not anymore. A strong resolve from Western governments, together with a growing market need, are engendering a new wave of REE projects outside of China. Africa is game for the challenge to provide an additional and/or an alternative REE supply, but it will require the best of the best projects to beat Chinese monopolistic prices.

China contains the largest reserves of the 17 elements, but this is not the only reason for – nor the only facet of – its dominance. Rare earth elements are found in mixed deposits, which makes it difficult to extract each individual element, let alone to do it profitably. Moreover, the mining and processing of REEs can have a heavy environmental impact. These barriers have left the sector in the hands of a few players, among which China Northern Rare Earth Group, the Australian Lynas Rare Earths, and the American MP Materials are some of the largest. However, underexploited deposits found outside of China, including those scattered across Sub-Saharan Africa, are commanding unprecedented interest.

A mass of demand forces coming together is driving the diversification of supply in the REE sector. The first is growth in demand for permanent magnets, where almost 30% of REEs go into. Magnets are a critical component of the high-tech industry, which includes the production of MRI machines, precision-guided weapons, and consumer electronics. Neodymium magnets (neo magnets) are also used in wind turbines. According to PS Market Research, neodymium could generate US$7 billion in revenue value in 2030 as its use becomes widespread in magnets for hybrid electric vehicles (HEVs), aircrafts, and consumer electronics. The same source suggests the global REE market should grow at a CAGR of over 9% between 2021 and 2030.

A big part of this demand will come from China. This makes the growing Chinese domestic consumption the second driver of change for the rare earths sector. Currently accounting for 90% of the production and 70% of the consumption of permanent magnets, China will leave one-third of global demand unsatisfied by 2035, reported Mining.com. To make sure it saturates its domestic demand, China started enforcing REE export quotas, preferring to invest in integrated supply chains for its dynamic tech industry instead of exporting critical raw materials. The third factor that is shifting the REE market is therefore the geopolitical sensitivity of depending on China for strategic materials. The application of REEs in critical sectors like defence and healthcare makes the dependence on China a delicate issue for Western countries. When the trade war between China and the US escalated in 2019, China increased REE prices, hurting American importers. China's near monopoly also means REE pricing is often opaque and weaponizable in a trade war - A very high price can be used as a tool against foreign downstream importers, while a very low price can be used to force out the competition.

Mark Billings, the executive chairman of Canadian-based REE producer and trader Auxico Resources, said analysts are not factoring in India's bike electrification plans. To electrify 400 million scooters and bicycles as it intends, India will require 100,000 t of neodymium, of which they can only buy about 74 t. "Sourcing these materials, whether by the car industry or by governments, will be incredibly challenging since the market is dominated by China, which supplies up to 100% of some rare elements and has a near monopoly on rare earth processing. Unlike publicly listed companies, Chinese players are quite secretive, so the rare earth industry remains closed," said Billings.

These demand dynamics are solid motives for the African mining sector to mobilize. Africa has never fallen short of delivering spectacular resources, and it does not disappoint in terms of rare earths. Though traces of REEs are found across both the eastern and western coasts of Sub-Saharan Africa, only a few stand out through possessing at least one of uniquely differentiating characteristics: extraordinary size, grade, low radioactivity, or simple mineralogy. For instance, in Uganda, Ionic Rare Earths is developing one of only three IAC (ionic adsorption clay) deposits in the world (outside of China) at the Makuutu rare earths project. IAC deposits, also known as "Weathered Crust Elution-deposited Rare Earth Ores," make up 35% of China's REE production. Typically found in China and Southeast Asia, there are only two other IAC deposits in Madagascar and in South America, besides Makuutu. The advantage of such a deposit is that the rare earth elements are found in a clay in a chemical form rather than a mineral form and can be extracted by washing the clay with a salt solution. With a mineral resource estimate of 532 million t, shallow mineral-

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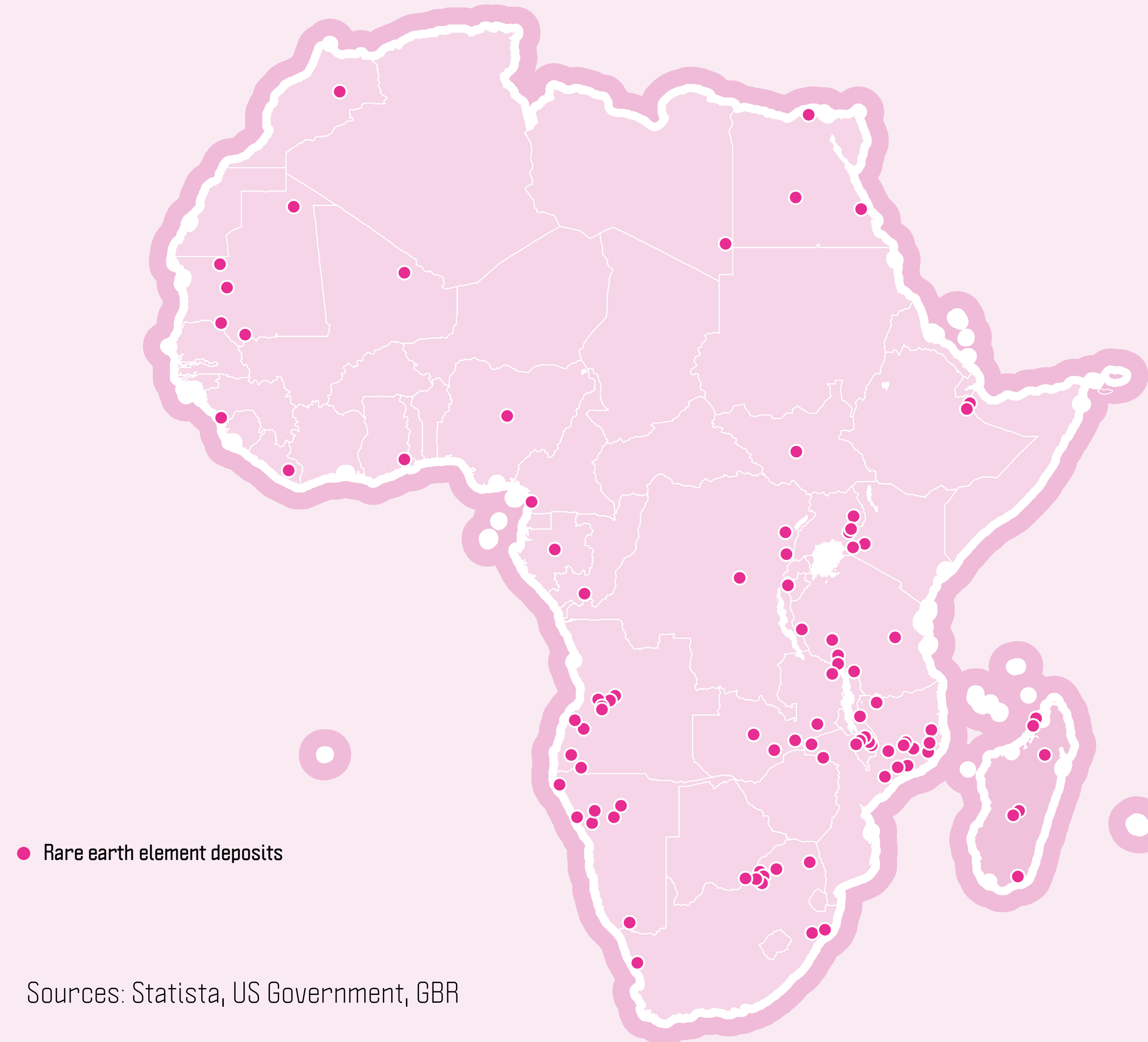
CHINA'S REE DOMINANCE

On reserves	On production	On processing	China also dominates the production of permanent magnets
37%	60%	85%	87%
of the total 120 million tons global reserves are found in China	of global production (China produced 168,000 tons of rare earth oxide in 2021)	of rare earth processing capacity is in China	market share of NdFeB magnet and about 50% production of high-performance magnets for EVs and wind turbines

WHERE COULD AFRICA PLAY A ROLE?



Sources: Statista, US Government, GBR

Asimwe Kabunga

CHAIRMAN
LINDIAN RESOURCES

What attracted Lindian to Kangankunde?
We believe Kangankunde represents a unique opportunity to prove up and develop a rare earths project of potentially global significance.

How is your strategy in the "Northern Corridor" evolving?
The Northern Corridor is the centrepiece of Lindian's long-term bauxite development strategy in Guinea. Our goal is to build an infrastructure framework which connects the company's Tier-1 bauxite projects with efficient transport logistics, comprising both in-country railway networks and shipping ports for export. With the location of our projects, Lindian is ideally positioned to benefit from the significant infrastructure investments that have been made in Guinea over recent years, which have now unlocked two high-grade bauxite provinces in Sangaredi and Boffa-Santou-Houda.

Could you comment on the company's outstanding performance on the ASX?
I think in particular we can see there was a response from investors following Lindian's acquisition of the Kangankunde project, which was formally recognised in August 2022. Accompanying the transaction, Lindian also completed two share placements during the year at a significant premium to the previous closing share price, which has also contributed to the company's strong recent performance on the ASX.

Do you have a final message?
For Lindian Resources, the next 12 months mark a particularly exciting juncture with respect to the ongoing development of our asset portfolio. Personally, my involvement with Lindian goes back more than five years now, and over that time my strategic vision has remained the same – to identify compelling resource exploration assets and bring in the right experts and management personnel to develop those assets in a way that benefits both our investors and the jurisdictions in which we operate. I think we are on the right track with that strategy, and I'm looking forward to working directly with our team and all relevant stakeholders to further unlock the value of our asset portfolio. ■

Tim Harrison

MD & CEO
IONIC RARE EARTHS

Could you introduce Ionic Rare Earths?
After confirming Makuutu as a difficult-to-find ionic adsorption clay (IAC) deposit, we rushed to secure an interest in the project in 2019. We have since defined a very large mineralized system stretching 37 km end-to-end, and published a mineral resource estimate (MRE) for 532 million t at 640 parts per million TREO, which covers only 26 km of that 37 km strike. With more exploration, there is significant potential to grow the resource, but at the current size, we can move forward to a staged approach to produce both magnet and heavy rare earths for several applications, including net zero technologies, defense and communications. Currently, we are finalizing the mining license application and we plan to do a demonstration plant in Uganda in 2023 to de-risk the project before reaching a final investment decision. In 2023, we want to see production at Makuutu.

The third facet of the company is magnet recycling: We extract the individual rare earth elements from spent magnets and to recover the rare earths and refine it back to high-purity oxides. We can thus provide sustainable and traceable magnets and heavy rare earths to Western governments.

What makes IAC deposits interesting?
Ionic adsorption clay (IAC) assets are very rare and most prevalent in China and Southeast Asia. This type of deposit has a lot of strategic value, derived from the composition of the basket of individual rare earth elements. The shallow, bulk mining and simple processing result in a low capital footprint, which allows us to start small at Makuutu, and scale up over time as demand grows and rare earth prices increase. China is the only country with existing refining capabilities for a rare earth carbonate mix like Makuutu. We are looking at developing our own refining asset to separate the mixed rare earth carbonate into 15 individual rare earth oxides. Geopolitically, the appetite to develop a refinery outside of China is very high. ■

Bardin Davis

CEO
PEAK RARE EARTHS

Could you briefly introduce Peak Rare Earths?
Peak is an ASX-listed rare earths development company. Our flagship Ngualla Rare Earth project in Tanzania is one of the largest, highest-grade, undeveloped rare earth projects in the world. Key points of differentiation include its high-grade, low levels of radionuclides, a 24-year life-of-mine supported by JORC-compliant ore reserves with substantial exploration and development upside. Approximately 92% of the value of Ngualla's high-grade rare earth concentrate will be attributable to contained NdPr (Neodymium Praseodymium) oxide, which is used in high-strength permanent magnets deployed in electric vehicles and wind turbines.

Can you comment on the key highlights of your recently updated BFS?
The recently completed 2022 Bankable Feasibility Study (BFS) Update reaffirmed the world-class nature of the Ngualla Project. Takeaways included annual contained production of NdPr of approximately 3,700 t/y and compelling economics including a US$1.5 billion NPV and a 37% IRR. We are targeting a final investment decision in May 2023, which will be followed by a two-year build and construction phase, with first concentrate targeted for mid-2025. The upfront capital cost is approximately US$320 million, of which 60-70% should be covered as debt, leaving the remaining balance to be financed through a combination of potential co-investment at a project level and an equity raising.

Peak Rare Earths has entered an MoU with Shenghe for the offtake of NdPr. How is this different from your original plan and what are the benefits of your new approach?
Our original plan was to develop a mine and concentrator in Tanzania in conjunction with a refinery in the UK. However, following negotiations with the Tanzanian Government, we have agreed to initially develop Ngualla as a standalone concentrate project and work with the government to explore further downstream processing opportunities. In this context, Peak signed a strategic and offtake MoU with Shenghe Resources, our largest shareholder and the largest importer of rare earth concentrate into China. This sequenced development approach enables us to reduce upfront capital and technical risk and generate operational cash flows before progressing further downstream. ■

Darrin Campbell

PRESIDENT
NAMIBIA CRITICAL METALS

Could you introduce Namibia Critical Metals?
Namibia Critical Metals is a TSXV-listed company active in Namibia since 2011. We hold the Lodfdal rare earth project, which we have developed into world-class heavy rare earth project. We also have a large portfolio of critical and precious metals in Namibia, but currently, we are focused on the tier-one Lofdal deposit.

What makes the Lofdal project unique?
We put out a maiden resource in 2012 and an initial PEA two years later but it was the work done in the last two years that established Lofdal as one of the richest dysprosium and terbium deposits in the world, outside of China. After a significant drilling campaign in 2020, we increased the size of our resource from 6 million t to an astonishing 53 million t, with 4.7 million kg of contained dysprosium and 725,000 kg of terbium.

Could you elaborate on what the JV agreement with the Japanese state agency JOGMEC entails?
In 2020, we entered a transformational transaction with the Japan Organization for Metals and Energy Security (JOGMEC), a state agency with an annual budget of more than US$15 billion and a mandate to secure supply of natural resources for Japanese industry. Under the JV agreement, JOGMEC can fund C$20 million in exploration and development, with the right to earn a 50% interest in Lofdal. JOGMEC can also purchase another 1% for a controlling stake, at which stage we can either participate at 49% or dilute to a carried working interest of no less than 26%. We are also receiving an operator fee that covers many of our overheads.

What can you tell us about operating in Namibia?
Namibia is probably the best African jurisdiction, coming second place in the continent within the 2021 Fraser Institute Survey of Mining Companies Report. ■

> *Longer-term, researchers globally have been consistent with their forecasts that demand for rare earths is expected to remain robust, particularly for elements used in the production of magnets which are a key component of electric vehicle manufacturing.*
>
> **Asimwe Kabunga**
> **Chairman, Lindian Resources**

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ization, and small overburden between three to five meters, Makuutu is an attractive resource with a low capital footprint, which makes it highly desirable.

Africa is also home to one of only two xenotime-type heavy rare earth deposits under development globally (outside of China) at the Lofdal heavy rare earth project of TSX-V listed Namibia Critical Metals. Lofdal is rich in dysprosium and terbium, two heavy rare earths that are considered more valuable than light rare earths like neodymium (Nd) or praseodymium (Pr). The resource is also sizeable (53 million t), with 4.7 million kg of contained dysprosium and 725,000 kg of terbium. Xenotime, a phosphate ore, is considered one of the more valuable mineral deposits of rare earths due to the low content of thorium, a radioactive element, and high content of heavy rare earths.

More common in Africa are monazite REE deposits, like the Kangankunde rare earth project that Lindian Resources acquired this year in Malawi. Kangankunde has a 21% NdPr sampled content and low thorium. The absence of thorium was also crucial for another African monazite sands deposit: REE concentrates from the Bafwasende in the DRC are shipped by Canadian company Auxico Resources, the exclusive trade agent for monazite sands in the country. Besides the intrinsic qualities of a resource, technology can also be a differentiating advantage for the success of African REE projects. Together with a team from the University of Montreal, Auxico Resources has developed an ultrasound-assisted extraction technology to accelerate the liberation of REEs at significant cost and environmental advantages.

Africa is also bound to be home to one of the lowest-cost producers of NdPr at the Phalaborwa REE project in South Africa. In the PEA published in October 2022, London developer Rainbow Rare Earths presented a very compelling case for a 30.7 million t inferred mineral resource with a cost of production of US$33.86/kg for separated rare earth oxides. This would make it the cheapest in the Western world. High grade and versatility also recommend another South African project, the Steenkampskraal mine, a high-grade monazite vein deposit which contains all of the lanthanide elements. Steenkampskraal has an MRE for 15,630 t of neodymium, 4,459 t of praseodymium, 867 t of dysprosium and 182 t of terbium, with a total combined grade of 3.49% and an average TREO grade of 14.4%.

Where there is geology, funding follows. Shenghe Resources, the same company that sponsored NYSE-listed MP Minerals, has recently signed an MoU with Peak Rare Earths, a junior developer in Tanzania. The largest importer of rare earth concentrates into China, Shenghe is taking steps towards securing supply from Peak Rare Earth's flagship Nguella rare earth project, one of the largest, highest-grade undeveloped REE projects in the world, with a capacity to produce 3,700 t/y of NdPr for 24 years. Japan, the largest consumer of dysprosium after China, is also alert for opportunities. State-owned Japan Organization for Metals and Energy Security (JOGMEC) recently acquired an option to earn 50% of Lofdal, a dysprosium and terbium project developed by Namibia Critical Metals. Just like Shenghe contributed in the past to the success of MP Minerals and is now supporting African player Peak Rare Earths, JOGMEC was also behind the success of REE leader Lynas Rare Earths, and has now moved to African-based Namibia Critical Metals. While Namibia Critical Metals and Peak Rare Earths are leveraging Asian interests, Auxico Resources is targeting Canadian financing: "The Canadian government has allocated C$3.5 billion in grants for the domestic production and processing of strategic minerals. We intend to apply for any subsidies, grants and government financing that could help us develop a rare earth refinery and in turn, strengthen the Canadian critical mineral supply chain for the energy industry," said Mark Billings, Auxico's executive chairman.

Equity-wise, African-focused REE companies seem to be a vehicle for both retailers and a good target for large investors. For example, CVE-listed Namibia Critical Metals has a tightly held stock of 196 million shares outstanding and 215 fully diluted, with Bannerman Energy owning 42% of the company after making a A$7.24 million payment this year, while its peer, the ASX-listed Ionic Rare Earths, has a very liquid stock with 3.9 billion shares on issue. ■

Graphite

The misunderstood other side of electric batteries

MAIN COUNTRIES:

Mozambique, Madagascar, Namibia, Tanzania and others

"Whatever the battery chemistry – be it nickel, manganese, cobalt, LFP, or other – graphite represents 48% of the battery's weight," said Hugues Jacquemin, the CEO of Northern Graphite, the only graphite producer in Canada and an emerging graphite producer in Namibia.

Jacquemin highlighted a fact that remains an afterthought in the battery value chain, but which, as industry insiders point out, is starting to raise serious concerns: "Some call the graphite problem to be 10 times the lithium problem. The graphite sector must work together, consolidate, and create opportunities of scale to respond to the growing appetite of cell manufacturers and OEMs," completed Jacquemin.

In the preoccupation with the cathode side of the battery (filled by lithium), the world seems to forget the anode side, where graphite is the most used material thanks to its low-cost and energy density. According to the Mining Journal (2021), the global demand for graphite is projected to rise from 1.1 million t/y in 2020 to 4 million t/y by 2030. Jacquemin says the industry will see a supply deficit of 40,000 t in 2023, which will grow further in the coming years. Demand will far outstrip supply unless more graphite mines enter production. But this is where the real challenge to the graphite problem lies that very few think about: "For anodes, manufacturers cannot swap one brand for another so easily. The investment community is not familiar with the inflexibility of the anode supply chain, assuming the same fungibility of lithium (which can come from multiple suppliers)," said John de Vries, the CEO of Black Rock Mining, a graphite developer in Tanzania.

Moreover, not all graphite can be used in anode material. This is what makes Black Rock Mining's Mahenge project in Tanzania a strategic asset, with very high grades and the ability to deliver 98.5% purity flake at a capacity of 340,000 t/y for 26 years: "A typical natural flake mine makes about 10,000-15,000 t/y of flake. Being able to produce large volumes of the same material is perfect for battery manufacturers, who normally blend material from multiple sources. With us, a battery OEM can secure their entire graphite supply from a single mine and therefore optimize their process."

Overlooked in the graphite industry is also the fact that there are few major developments in the graphite supply, for various reasons. Whereas the cathode side of batteries relies on spodumene or brine producers to sell either lithium carbonate or lithium hydroxide to a cathode manufacturer, who will then reach cell makers, the anode side typically requires more vertical integration. Graphite producers must first prove the suitability of their supply to cell makers by investing in demonstration plants and undergoing extensive testing. For example, Black Rock Mining (BKT) ran a 500 t pilot plant in China. Of course, such exercises require significant time – up to four years to test the material, according to John de Vries, the CEO of BKT – but also financing, and this is another irony of the graphite supply chain: Not being a traded commodity, graphite does not have a "spot" price established in the market, so there is no reference pricing that can guide a project evaluation. This makes banks unable to gauge the value of a project and lend money. One solution to this problem is to present investors with a broadly de-risked project that has already attracted offtake bidders. In that sense, BKT signed a conditional framework agreement with Urbix for the exclusive offtake of natural graphite fines. According to its top executive, this arrangement makes BKT the only graphite company seeking out bank debt.

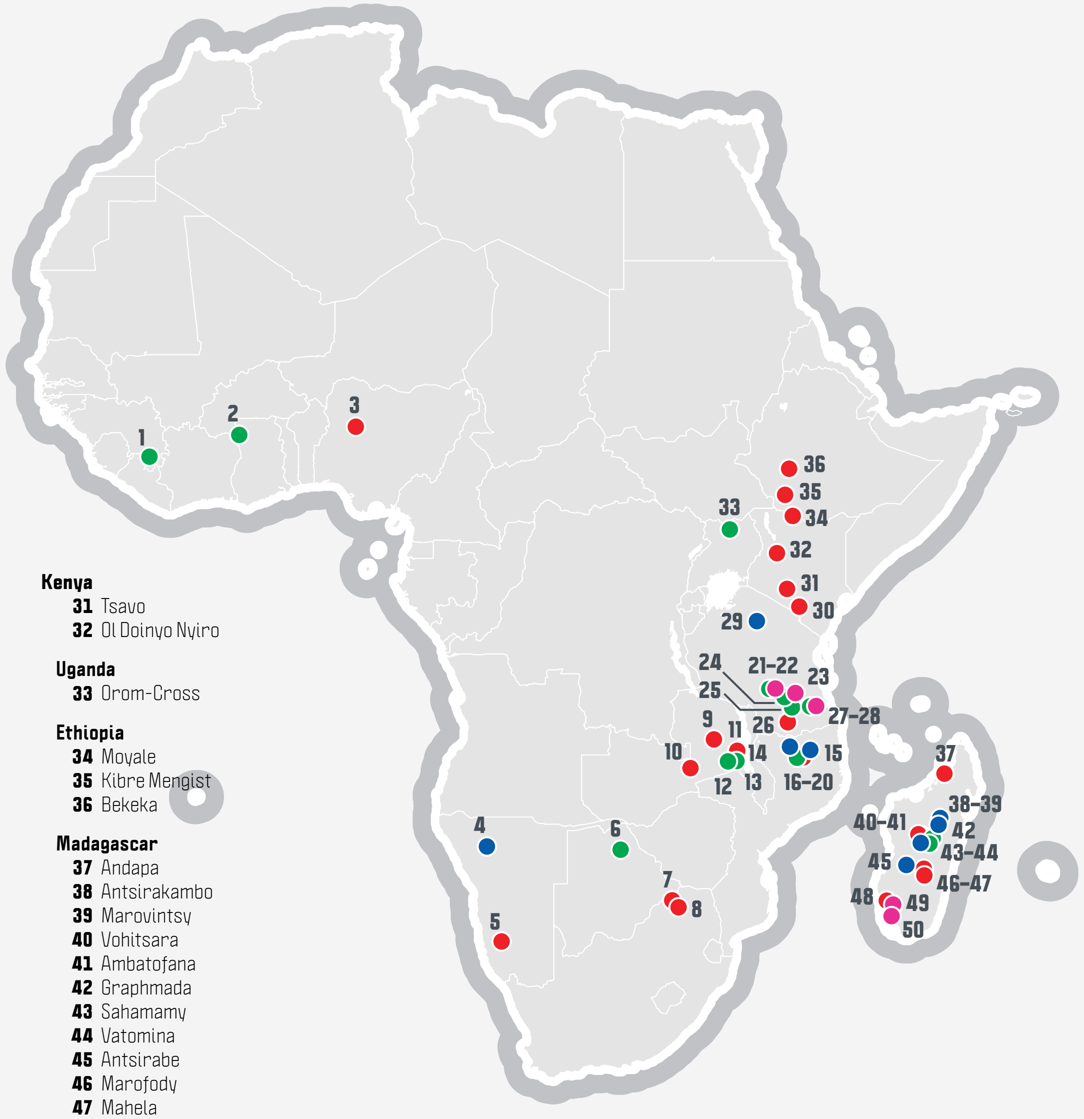
When it enters production, BKT's Mehenge will be comparable to the world's largest graphite mine, also found in Africa: The Balama mine in Mozambique has a LOM of 50 years and produces 350,000 t/y of graphite. Balama, together with other mines found mostly in Mozambique (Balama and Ancuable mines), Madagascar (Antsirakambo, Marovintsy, Graphmada, and Sahamamy Sahasoa deposits), and Namibia (the Okanjande mine), make Africa the third largest producer of graphite in the world, after China and Brazil. China takes the lion's share of graphite production with almost 70% of the market. The most common type of graphite found in Africa is flake graphite, associated with metamorphic rocks.

The perception of graphite as an abundant and relatively cheap industrial mineral used in steel manufacturing and metal bearings, brake linings, lubricants, and paint and pencil lead, has led to a sense of complacency in the graphite industry. But the new use of graphite in lithium-ion rechargeable batteries is expected to drive an awakening in the industry, especially as EV producers are looking to reduce their dependence on China and to develop more local supply chains to avoid logistics bottlenecks. Even though synthetic graphite competes with natural graphite in the battery anode market, and some forecast synthetic graphite will eventually overtake natural graphite, the production of synthetic graphite is riddled with challenges. Synthetic graphite is more expensive to produce and has a higher CO2 footprint, which contradicts decarbonization efforts. On top of this, most synthetic graphite is made in China.

The price of graphite has not seen the spectacular jumps of its lithium counterpart, but there is a sense in the market that this will change as the various supply challenges explored in this article become more obvious. ■

MAP OF GRAPHITE RESOURCES IN AFRICA (WITH LOCALITIES)

EARLY STAGE EXPLORATION ▶ DEPOSIT IDENTIFICATION ▶ RESOURCE DEFINITION ▶ PRE-FEASIBILITY STUDY ▶ DEFINITE FEASIBILITY STUDY ▶ BANKABLE FEASIBILITY STUDY ▶ DEVELOPMENT ▶ PRODUCTION



Guinea
1 Lola

Ghana
2 Kambale

Nigeria
3 Saulawa

Namibia
4 Okanjande
5 Aukum

Botswana
6 Pencil Hill

South Africa
7 Steamboat
8 Goodhope

Zambia
9 Njoka
10 Mkonda & Mvuvye

Malawi
11 Katengeza
12 Malingunde
13 Duwi

Mozambique
14 Balama
15 Ancuabe
16 Balama central
17 Caula
18 Montepuez
19 Nicanda Hill & Nicanda West
20 Nipacue

Tanzania
21 Epanko
22 Mahenge
23 Lindi Jumbo
24 Pula
25 Chilalo
26 Nachingwea
27 Bunyu
28 Nachu
29 Merelani
30 Kanziku

Kenya
31 Tsavo
32 Ol Doinyo Nyiro

Uganda
33 Orom-Cross

Ethiopia
34 Moyale
35 Kibre Mengist
36 Bekeka

Madagascar
37 Andapa
38 Antsirakambo
39 Marovintsy
40 Vohitsara
41 Ambatofana
42 Graphmada
43 Sahamamy
44 Vatomina
45 Antsirabe
46 Marofody
47 Mahela
48 Ianapera
49 MOLO
50 Maniry

Sources: British Geological Survey 2021

Hugues Jacquemin

CEO
NORTHERN GRAPHITE

Northern Graphite acquired the Okanjande graphite deposit together with the Okorusu processing plant in Namibia in April 2022. What has attracted the company to these assets?

Okanjande was developed in the 1990s by Rio Tinto. Just 22 km away from the mine, Okorusu was an old fluorspar plant owned by Solvay. The brownfield facility presented us with the opportunity to convert it to a graphite processing plant and reduce capital costs. In 2016, Imerys acquired both the mine and plant and began mining that same year. Two years later though, as graphite markets were highly depressed, Imerys put the plant on care and maintenance. After thorough due diligence, Northern Graphite acquired these two assets earlier this year. Our goal is to start production in the next 1-2 years. Based on the recent PEA, the estimated CAPEX to restart the operation is US$15 million.

Graphite prices are yet to react to the supply-demand imbalance. Why is that?

The pricing of graphite has undergone repeated cycles, affected primarily by China's irregular supply into European and North American markets. Because graphite pricing is quite opaque, lacking sufficient market data to inform investors and developers, the financing of graphite projects becomes challenging.

What makes Namibia a favourable mining jurisdiction?

Namibia is a business-friendly jurisdiction with a history of uranium mining and talented people with an abundance of mining expertise. The country has a relatively stable currency, pegged to the South African Rand. The proximity to South Africa also gives us the advantage of being able to pull in local engineering talent. Okanjande is only 5 hours' drive away from the deep-water port of Walvis Bay, which provides perfect shipping connectivity into Europe and North America.

Do you have a final message?

Northern Graphite found in Namibia a permitted project that can easily expand into a world-class operation. The graphite sector must work together, consolidate, and create opportunities of scale to respond to the growing appetite of cell manufacturers and OEMs. ■

John de Vries

CEO
BLACK ROCK MINING

Black Rock Mining is developing the 100%-owned Mahenge graphite project in Tanzania. Can you tell us more about Mahenge?

Geologically, Mahenge is incredibly advantageous. The deposit sits at the top of a mountain where the ground has been eroded, pushing the graphite to the surface. The deepest and therefore purest and more valuable flake is up-thrusted right at the top of the mountain, positioning the project at the premium end of the curve. While most other suppliers struggle to reach a 95% purity, 95% is already the lower-grade component coming off our plant. We can produce 99% pure material by flotation, that is without chemical intervention, something that no one else has done. According to the Updated eDFS, the four-stage construction schedule could deliver 340,000 t/y graphite concentrate (98.5%) for a LOM of 26 years, with the ability to produce ultra-pure flake of 99% LOI premium. A typical natural flake mine makes about 10,000-15,000 tons of flake. Being able to produce large volumes of the same material is perfect for battery manufacturers, who normally blend material from multiple sources. With us, a battery OEM can secure their entire graphite supply from a single mine and therefore optimize their process.

In December 2021, BKT together with three other companies in the country signed a framework agreement with the government of Tanzania, why is this significant?

Tanzania enacted free-carried participation of the state in all projects, but the mechanics of implementation had been unclear. The framework agreement set up the mechanics and governance principles for JV companies, which are necessary to attract debt finance and run the company. With 30% tax rate, 4% royalties and inspection fees, and 16% free carried interest, the Tanzanian government becomes a 50% partner for the project.

What have been the latest developments over the last 12 months?

The last 12 months have been transformational for the company and for Tanzania. Besides the framework agreement, we have also obtained our Special Mining License and had our FEED (front-end engineering design) reviewed by an independent technical expert. ■

Base Metals

Rocky short-term fundamentals do not deter African players

"We believe in zinc and the demand for zinc to galvanize industrialization and the infrastructure required to boost economies worldwide."

Pushpender Singla
Executive Director and CFO, Vedanta Zinc International

MAIN COUNTRIES:

- **Copper**: The DRC, Zambia, (also) Morocco, South Africa, Eritrea
- **Zinc**: South Africa, (also) Namibia, Eritrea
- **Bauxite**: Guinea (biggest in the world), (also) Sierra Leone, Ghana, Mozambique
- **Tin**: The DRC, Namibia

The production of base metals in Africa is concentrated in three key regions: The Congolese and Zambian Copperbelt, as the second largest copper producer in the world after Chile; Guinea, by far the world's leader in bauxite; and the Northern Cape province of South Africa, as the main zinc source for the continent and with rich copper resources. More marginally, tin is mined in the DRC and Namibia.

Distinguishing themselves with projects of superior size and quality, these regions have been the key receivers of big investments over the past few years. Following the multi-billion-dollar investment by Ivanhoe Mining, the Kamoa-Kakula copper project in the DRC is set to become the third largest copper mine in the world by 2024. With an investment of R7 billion (about US$413 million), the largest undeveloped zinc resource is being developed by Vedanta Zinc International in South Africa. The Gamsberg zinc project will double production to 500,000 t/y by 2024. Also in the remote Northern Cape province of South Africa, AfriTin is operating one of the largest hard rock opencast tin mines globally.

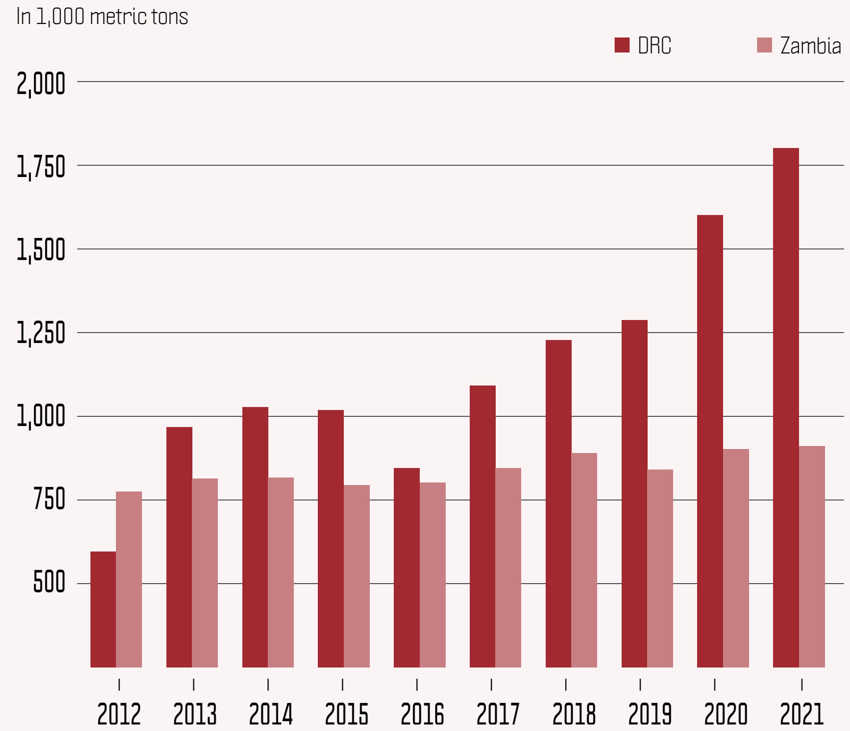
Investments have also started to spill outside of these well-tested formulas that associate the DRC with copper or Guinea with bauxite, targeting brownfield projects mostly. Ivanhoe diversified from its main commodity (copper) to zinc, after signing an agreement with DRC state-owned Gécamines to restart production at the Kipushi zinc mine, which had been in operation between 1924 and 1993. Ivanhoe thinks it can expedite the mine to commercial production in just two years by leveraging the infrastructure in place. With average grades of 36.4% for the first five years of production, Kipushi is easily the world's highest-grade zinc deposit.

While Ivanhoe adds more zinc mining on the DRC map, the continent's biggest gold producer, Barrick, is also looking at more copper projects in the Copperbelt, where it operates the Kibali gold mine in the DRC and the Lumwana mine in Zambia. Its CEO Mark Bristow alluded to an untested theory that the Copperbelt might extend into other countries, potentially to the southwest of the Congo into Angola. At the opposite end at the northeast border of Congo, Uganda began the hunt for an investor to take over the Kilembe copper mine, the biggest in the country, which ran between 1952 and 1982. Kilembe was put on care and maintenance due to depressed copper prices.

In the last two years, base metals went through dramatic episodes of record or near-record declines and rebounds. Copper, the most used base metal, saw its steepest drop during the pandemic in 2020. Two years later, the price of copper reached its highest point ever, climaxing at US$5.02/lb in March 2022. Also in March, aluminum and zinc prices traded at their second-highest levels in history. All three metals retreated since, but copper seems to have found a floor just below US$7,000/t, which is much

ANNUAL COPPER OUTPUT BY THE TWO BIGGEST AFRICAN PRODUCING COUNTRIES

Source: Statista



> *There is a lot of uncertainty around China, but the most volatility seems to emerge from the housing market, which is the culprit for lowered demand for copper, and a general trend of degrowth in the past two years.*
>
> **Navin Dalmia**
> **CEO, Rubamin**

higher than its five-year trend, but the outlook forward is filled with mixed signals.

Copper is sensitive to negative economic activity shocks, which a report by the World Bank found to contribute 74% to the variance in the copper price. Pessimistic demand expectations, recession fears, and softening demand from China are therefore expected to further weaken prices in the following quarters. In the short-term, supply risks radiating from Latin America, but also inflation-driven or pandemic-driven disruptions could also push the price higher, though capacity additions, including those in the DRC, will again fiddle with the price. In the long-term, however, the growth in demand for metal-intensive renewables required in the energy transition poise copper, as well as aluminum and zinc, for strong growth. The International Energy Agency (IEA) says the building of solar photovoltaic plants, wind farms, and EVs require more critical minerals than fossil fuel infrastructure. According to the IEA, an electric car consumes six times more minerals than a traditional car, whereas an offshore wind plant uses 16 times more minerals compared to a corresponding gas-fired plant.

Copper is seen as a winner of electrification, but the problem with this positive assumption is the time gap between now and then (or the time for renewables to replace fossil fuels). At present, most copper demand comes from industrial applications like the construction sector, and China, which accounts for more than half of copper consumption. The now is characterized by a declining – some would even say collapsing - real estate Chinese market, together with other macro headwinds. For now, renewables are a small part of the demand for copper and other base metals. In 10 years time, however, between 7.6 to 11.3 million tons of new mine capacity will be required to fill the copper supply gap, according to Wood Mackenzie. Then, prices will surely rise.

So are these long-term price assumptions enough to incentivize mining projects when soaring inflation, and feeble sentiment make the discovery and development of new mines so difficult? According to EY, the US$6,726/t average copper price in the last six years has been below the so-called incentive price, calculated by the audit firm to range between US$7,000 and US$8,000 for new project developments. Experts think copper will stay above US$7,000/t through 2024.

African players understand the long-term game: "The reality of grade decline, lack of future mine development opportunities, and copper resource depletion will likely result in higher prices. Regardless of any near-term uncertainty, we are very confident in the copper market over the mid- to long-term," said Marna Cloete, president of Ivanhoe Mines.

Smaller players must think strategically to survive market volatility. In the quest to find capital, base metal junior developers are resorting to selling the precious by-products of their projects where these are available. Trigon Metals, a junior operating in Namibia and Morocco, announced in July this year a silver streaming agreement with Sprott Streaming worth at least US$25 million. Trigon will sell the silver by-product resulting from its Kombat copper project and spend the cash on developing the underground mine. In South Africa, junior developer Orion Minerals has also secured a streaming finance arrangement with Triple Flag Precious Metals for an upfront investment of C$87 million. In exchange, Orion committed a portion of its gold and silver byproduct for the life of mine of its flagship Prieska copper project. Aside from precious metals, Orion has also eyed opportunities in a nickel component at its other project, Okiep, which it acquired last year. The Okiep copper mine is a former Newmont and Gold Fields operation and was closed down when copper prices dropped. Okiep is said to hold more than 50 million t of copper ore, but what attracted Orion to the asset is the mineral- ization style, which creates optionality for nickel and platinum com- ponents. "For the first time in the mine's history, we drilled for this style of mineralisation and made a nickel discovery. Moving forward, we will be focusing on the nickel potential as well as the copper min- eralization. Our strategy for Okiep is to get a small mine running and generating cash as early as possible," said Errol Smart, Orion's CEO.

Image courtesy of MCSC.

While finding viable financing options in the short term, developers of base metal projects are also engaging in long-term thinking, positioning their projects in a way that they couple themselves to the energy transition. Orion, for instance, sees a future in the high-value metals space, where highly refined micro-powders of nickel, lithium, phosphor, and cobalt, often found in conjunction with copper ore projects, sell for a premium. "Neglected, orphan ore bodies, whose development had been sub-economic, could get a completely new lease of life," Smart said.

The opportunity to sell into a premium, greener market is common for other ores. The owner of the recently acquired Simandou North project in Guinea, junior explorer Arrow Minerals, also wants to use the high-grade iron resource found at its project to tap into the electric furnaces market. Traditional smelters are powered by coal, but a new market of electrically powered furnaces create an opportunity to make "green" steel with a much lower CO2 footprint. Only some resources can be used to feed this niche market: "There is a big push for electric furnaces that use hydro or solar power in combination with hydrogen fuel to reduce the carbon output, but these types of furnaces consume quite a lot of energy, which means they require high grades to make them economical. The ideal scenario is to use a high-grade iron ore with low LOIs (low phosphorus and low silica), or else we can use a beneficiated high-grade iron briquette, said Hugh Bresser, managing director at Arrow Minerals. ■

Marna Cloete

PRESIDENT
IVANHOE MINES

> *Africa has an exceptional endowment of essential mineral resources required to decarbonize the global economy and help achieve the commitment to a zero-emissions world.*

Can you elaborate on Kamoa-Kakula's first year of production and the mine's expansion program?

Kamoa-Kakula has produced over 345,000 tonnes of copper since first production in May 2021. The Phase 1 and 2 debottlenecking project to increase combined capacity to 9.2 mtpa is underway and completion remains on track for Q2 2023. Upon commencement of Phase 3 production, the Kamoa-Kakula Mining Complex will have a processing capacity in excess of 14 million tonnes per annum. Phase 3 is expected to increase copper production capacity to approximately 600,000 tonnes per annum, with commissioning expected by the fourth quarter of 2024. This production rate will position the Kamoa-Kakula Mining Complex as the third-largest copper mining operation in the world.

How are global inflationary pressures impacting Ivanhoe's overheads and project expansion costs?

The Phase 1 and Phase 2 concentrator plants and associated mines at Kamoa-Kakula were delivered ahead of schedule and on budget, with Phase 2 achieving steady-state production in May 2022.. Fortunately many of the long lead items have already been procured and prices locked in. The expansion also includes a 500,000-tonne-per-annum, direct-to-blister flash smelter, which will be the largest in Africa. Also, Kamoa-Kakula has secure power from the DRC's extensive hydroelectric grid, which has certainly had an insulating effect on the operation's energy costs.

How has the Ivanhoe stock performed in the past year in a context of heightened volatility in copper prices?

Ivanhoe Mines' stock has performed very well given the volatility in copper prices and related macroeconomic uncertainty recently. We have come a long way over the past two years, and our share price has reflected the strong operating performance during ramp-up and first production at Kamoa-Kakula. We recognize that there will be supply-demand challenges in the copper market. The demand from traditional end–uses like construction and manufacturing activities may have slowed in the short term due to lock downs in China and slowing manufacturing growth in the US, yet we know demand will be solid long-term with the added focus on renewable energy and electrification. The rising global demand for EV's, EV charging infrastructure and energy storage applications will be one of the biggest drivers of copper consumption, and copper demand from this sector is expected to surge.

What have been the key developments at the Platreef PGM development project in South Africa?

Our first significant milestone was in May 2022 when we concluded the construction of the Shaft 1 production changeover. Lateral underground mine development, which commenced in April 2022, continues to advance well on the 950 level. Development on the 750 and 850 levels will commence in Q3 and Q4, respectively. The construction of Platfreef's first solar-power plant began in Q3 2022 with commissioning expected next year. The electricity generated from this power plant will be used for mine development and construction activities, as well as for charging Platreef's battery-powered underground mining fleet.

What are the core elements to the recent agreement between Ivanhoe and Gécamines for Kipushi?

Kipushi is an important asset for Ivanhoe and signing the agreement with Gécamines will allow us to expeditiously return this ultra-high-grade mine to commercial production in just two years. This is a brownfield investment; we are not starting from scratch. The infrastructure is in place, it's a matter of upgrading it, applying technological updates and responsibly bringing this historic mine up to 21st century standards, therefore, it will require some capital outlay.

Zinc is an important metal necessary for the green energy transition and Kipushi will be the world's highest grade major zinc mine, with an average grade of 36.4% over the first five years of production. Gécamines has operated this mine for a long time, and now working as a joint-venture with Ivanhoe we can optimize the positive economic benefits and social impact for the local communities and the DRC's mining sector as a whole.

Do you have a final message for our international audience?

Africa has an exceptional endowment of essential mineral resources required to decarbonize the global economy and help achieve the commitment to a zero-emissions world. ■

Pierre Léveillé

PRESIDENT & CEO
DEEP SOUTH RESOURCES

Could you give us a background into the legal battle to renew the license at the Haib copper project in Namibia?

After closing the deal with Teck in May 2017, Deep South Resources applied to renew the licence, which was granted without problems; we developed the project for four years. In 2021, the Ministry removed the licence on grounds that Deep-South did not carry out substantial exploration during the last tenure. We have been fighting in court with the Mining Ministry to revoke the decision.

What has Deep South Resources done differently to prove the project is economic, as per your PEA?

All the companies that came before us treated Haib as a typical 100–500-million-year porphyry like those found in the Andes, but the Haib copper deposit is 1.8 billion years with a very different geology. While previous companies drilled for tonnage and vertically, we were the first to drill inclined, finding shear zones and faults with high-grade material never identified in any geological maps. Furthermore, instead of using the classical model of minerals extraction, we found that Haib meets all the conditions for Bio Heap Leaching. The two most important conditions are external temperature and pyrite content: The south of Namibia being one of the hottest places on earth, and our tests showed Haib contains at least 5% pyrite.

Deep South Resources has acquired three licenses in Zambia. What has attracted you to Zambia?

We acquired 80% of three licenses in the Zambian Copperbelt, a region which hosts 14 active major mines while remaining largely underexplored. The Chililabombwe project is 7 km from the Konkola mine and on the same geological structure. Our Luanshya West is 20 km away and analog to the same geological trend. And finally, 30 km west of Luanshya West sits Mpongwe, our largest license stretching 735 km^2. We have filed the environmental project briefs with the Ministry in Zambia and we are awaiting approval to start soil sampling programs. ■

Errol Smart

CEO
ORION MINERALS

Why has Orion Minerals changed the development plan at its flagship Prieska copper-zinc project?

The original plan for Prieska was to immediately ramp up to reach 2.4 million t/y of copper ore milled. As the markets changed, we saw a growing appetite to support lower-risk and lower-capital allocations, with an early start and slower ramp-up. While in the initial BFS we intended to mine the historic Crown pillar of the mine (which holds over 1 million tonnes of high grade ore) at the end of the life of mine, in our revamped plan we decided to bring this to the front along with select remnant pillars. This could immediately put us on a path to earlier production of 1.2 million t/y, while we dewater the deep portions of the ore body and then ramp-up to 2.4 million t/y. Also, rather than mining the crown pillar as an open pit, with big pre-strip requirement, we are now looking to create a shallow underground operation.

How has the case for energy generation changed in your updated BFS?

The availability of renewable energy had a huge impact on both the energy security and the potential cost of energy for our mine. The market is moving thrillingly fast and new doors are opening, which also means the input parameters for developing new mines need to be reviewed. Suddenly, mines like Prieska, which were already on a path to carbon neutrality, could even potentially become a net carbon sequestrator making them attractive targets for financiers looking to offset carbon credits.

Could you familiarize our audience with your second project, the Okiep copper project?

What peaked our interest is the intrusive ultramafic style of mineralization, similar to what we have in Australia. Almost without exception, these ultramafic intrusive ore bodies have a nickel and platinum rich (PGE) component. For the first time in the mine's history, we drilled for this style of mineralisation and made a nickel discovery. Moving forward, we will be focusing on the nickel potential as well as the copper mineralization. ■

Diamonds

African diamonds post the Russian ban

- **Main Countries**: Botswana, the DRC, South Africa, Angola, Zimbabwe, Namibia
- **Other**: Sierra Leone, Lesotho, Guinea

> *"The gem industry is still misunderstood. Gems are a luxury product and are therefore not sought after in poor economies and are a second thought during economic turmoil in first world economies. Neither the government nor the banking sector lends much support to gemstone dealers."*
>
> ***Diana Atieno***
> ***Founder, Porini Gems***

The world of diamonds is a small one. At a first glance, diamonds come from many parts of the globe – Russia, first and foremost, followed by Botswana, Canada, DRC, South Africa, Angola, Zimbabwe, Namibia, among others. In reality, only a handful of companies control diamond production, and, in almost all cases, the main producers conflate with the producing country and its government: Alrosa, the world's biggest producer of diamond and owned 33% by the Russian government, accounts for 94% of Russia's total diamond production – 38.5 million (Mct) carats every year, according to Statista. Whereas Alrosa stands for Russian production, De Beers is fundamentally African, with operations in South Africa, Botswana, Namibia, Zimbabwe, as well as Canada. With an annual production of 30.78 Mct, the majority owned AngloAmerican company operates in a 50:50 partnership with the Batswana government under the umbrella of JV company Debswana. Debswana controls the Jwaneng open pit mine on the edge of the Kalahari Desert. Jwaneng is considered the richest diamond mine in the world by value and contributes to up to 70% of Debswana's revenue. With a similar monopolistic role, Catoca is the largest diamond company in Angola.

In this small universe of diamond mining, the banning of Russian diamonds from international markets created a deep supply shock in the markets. The CEO of Alrosa, Sergei Sergeevich Ivanov, was among the first Russian oligarchs to be sanctioned by the United States in light of the Russian invasion of Ukraine.

The US Office of Foreign Assets Control (OFAC) sanctioned Alrosa, denying Russian banks access to SWIFT services for international payments so they could not service the diamond miner. President Biden also banned the import of Russian diamonds in the US. Jewellery brands refused to buy Russian diamonds, while insurance companies and logistics providers declined their services too. But in Europe, the EU excluded diamonds from its sanctions list to protect trade in Antwerp, the Dutch-speaking Belgian city traversed by 86% of the world's diamonds. English newspaper The Guardian reported that Belgium has continued to import Russian diamonds despite global sanctions, even though in smaller quantities: In August 2022, Belgium was importing 83% fewer diamonds compared to the same month in the previous year, wrote the same source.

With the removal of the world's first diamond producer (Russia), the world's second (Botswana), fourth (the DRC), fifth (South Africa), sixth (Angola), seventh (Zimbabwe) and eighth (Namibia) should have an opportunity to come forth, driving the African diamond industry. But, as some industry experts point out, Russian diamonds continue to find their way back into the market, and legally too. For example, the ban on imports only applies to rough stones mined or cut in Russia, but most Russian originating diamonds are sent for cutting and polishing to a different country. Rough diamonds from different countries of origin are mixed together for trading purposes, which deems them classifiable as "of mixed origin" under the standard Kimberley Process (KP) verification rules. Also, under different international treaties, "country of origin" can also signal the country where the product undertook a substantive transformation, which is often different from where the raw product was sourced. Alrosa diamonds also reach the market through other major trading centres where sanctions were not imposed: "Buyers are nothing if not ingenious; as neither India nor China did not participate in the sanctions, Russian diamonds from Alrosa started to find their way back into the market," said Clifford Elphick, the CEO of Gem Diamonds, a London-listed producer with operations in Lesotho.

So where does this leave African mining? The conflict in Ukraine created two major un-cyclical changes in the diamonds market: The first and more short-lived is that diamond prices were driven up by the supply cuts; the second change is the after-effect of subdued global economic growth which is impacting the diamonds industry negatively in the longer-term. The global diamond industry usually moves in predictable synchrony with the global economy and consumer trends. In 2020, global rough diamond production suffered a 19.4% plunge to 111.4 Mct. Based on GlobalData estimates, diamond output should reach 124.8 Mct in 2025.

Diamond operators in Africa must prove operational excellence and a transparent supply chain to be able to replace Russian diamonds and capture a larger market share. The association with "blood diamonds" has plagued the industry for years, and even respected companies cannot fully escape the derogation, almost 20 years after the Kimberley Process Certification Scheme was first implemented to safeguard against conflict stones. Technology has been an important tool at the service of miners. For instance, Debswana deployed the Ariba cloud solution to enhance supply chain collaboration. Lucara, a London-based company with a large mine also in Botswana, is growing in-house digital marketplace Clara, which is underpinned by blockchain. ■

> *"Some mining companies are pulling out or holding back on significant investments until there is more clarity around the final cost structure of their projects. Diamonds represent our core market in the continent and we believe demand for sensor-based sorting in the mining industry will continue to grow."*
>
> ***Albert du Preez***
> ***SVP and Head of Tomra Mining, TOMRA***

5 OF THE TOP 10 MOST EXPENSIVE DIAMONDS IN THE WORLD COME FROM SOUTH AFRICA

1. **The Cullinan Diamond** $400 million
2. **The Hope Diamond** $350 million
3. **Diamond De Beers Centenary** $100 million
4. **The Steinmetz Pink** $71.2 million
5. **The Blue Diamond of Oppenheimer** $57.5 million
6. **Graff Lesedi La Rona diamond** $53 million
7. **Princie** $39.3 million
8. **The Rock** $21.9 million
9. **The Heart of Eternity** $16 million
10. **Mountain of Light Diamond (Koh-I-Noor)** Unknown

Eira Thomas

CEO
LUCARA DIAMOND

Lucara is moving forward with the US$547 million underground expansion of the Karowe diamond mine. Could you update us on the progress of the project?

Karowe will be the first underground diamond mine in Botswana. We began this project about 20 months ago, and in Q3 2021, we completed the financing. Karowe is a long built, expected to take a couple of years to finalize; we need to sink the shafts and complete the lateral development before we deliver the first underground ore in 2026.

Could you comment on the key demand trends you observe?

Lucara's value comes primarily (over 70%) from the production of high-value diamonds of more than 10.8 carats in size, which isolates us from the volatility in consumer markets. As consumers feel the pinch of inflation, small diamond producers are likely to come under pressure. Interestingly, in our space, we see people buying large diamonds as a hedge against inflation and as a way to diversify their portfolio with a hard asset, a trend often seen with gold. Prices for large diamonds have stabilized and we do not note any major headwinds moving forward.

Could you give us a better sense of the operational environment that Botswana offers?

At Lucara, we see Botswana as the Switzerland of Africa, as it is often epitomized, for its ease of doing business and highly educated workforce. 99% of Lucara's employees are Batswana, including our top management. In fact, our managing director in the country, Naseem Lahri, is the first female MD of a mine in the country. Since beginning our activity in the country almost a decade ago, we have matured our sustainability agenda and are committed to leaving a lasting positive impact in the country. In 2018, Lucara became a member of the UN Global Compact, and we report on 10 of the 17 SDGs. ■

Clifford Elphick

CEO
GEM DIAMONDS

Could you introduce Gem Diamonds and the Letšeng diamond mine in Lesotho?

The diamonds recovered at Letšeng are, by far, of the highest quality in the world, with US$2,000-carat goods on average. About 80% of our revenues are derived from top-value diamonds. Letšeng is unusual because it has two kimberlites (500 m apart), which are mined simultaneously. In operation since 2004, the mine has become deeper and we are examining closely the possibility to go underground. We also have a mine in Botswana, Ghaghoo, which is on care on maintenance and we are currently looking for a buyer. As far as expansion is concerned, we have been scouting Angola for some time now, identifying very promising opportunities, some early stage and other already existing mines.

Can you elaborate on the operational particularities of running a mine at 3,200 m altitude?

Letšeng sits at one of the highest points in Lesotho (and South Africa). Logistics are difficult, particularly for heavy earthmoving and loading equipment, which need to be disassembled before being transported over narrow roads with many switchbacks. High winds and snow can also make electricity an issue. Gem Diamonds employs about 1,500 people in Lesotho. Without any major towns close by, people work on rotation, moving in and out of the site. We export the diamonds via helicopter to Johannesburg.

What are your key objectives for 2023?

Cash flow generation is always the name of the game for a public company, and for us, this translates into a search for efficiencies and keeping costs under control. We are looking at technologies to always improve, extract the product quicker, cheaper, and with less diamond breakage. We are also running a trial supplying diamonds to luxury goods company LVMH, which recently launched a high-end brand. We started cautiously with small volumes, but we want to expand. ■

Benedito Paulo Manuel

MANAGING DIRECTOR
SOCIEDADE MINEIRA DE CATOCA

What are the main demand trends you have observed in the diamond industry?

We believe that, as a country, we will have an increasing participation in the international diamond market, resulting from the expansion of the availability of Angolan diamonds in the world market as a consequence of the start-up of new projects in the prospecting phase and some already in production, such as the Luele mine in the Luaxe concession.

We are also encouraged by the fact that the forecasts for the coming years point to a potential growth of the diamond consumption market, both for jewellery and industrial purposes.

How has the fiscal and economic climate in Angola changed in recent years for investors?

The fiscal and economic climate has seen significant advances in recent years, creating a very favourable environment for investors. In addition to legislation being improved, there has been a major focus on the quantity and quality of information about diamond occurrences and facilitated procedures to access this information for investment purposes.

The "Planageo" [National Geology Plan] includes all the essential information on anomalies, occurrences and reserves, access procedures and more. It is a useful tool for investors. Likewise, there has also been a significant improvement in the number of junior prospecting companies whose presence is essential to attract large mining companies to Angola.

What is Catoca's commitment to sustainability?

Catoca is proud to be the catalyst of economic and social development of the Eastern region of Angola. Our projects cover education, health, youth and sports, culture, entrepreneurship, water supply programs, and agricultural development programs.

What are your main priorities for 2023?

It is important to highlight the great challenge of increasing our reserves, since the date for the conclusion of the Catoca mine exploration in the manner we do today (open pit) is getting closer. This could lead us to an underground mine, because there are indicators that point to the existence of reserves below 600 m in the Catoca kimberlite. ■

Andrew M. Motsomi

MANAGING DIRECTOR
DEBSWANA

What have been the main developments at Debswana over the past year?

Debswana has embarked on a long-term strategy with a five-years step change dubbed Debswana Strategy 2024 and themed "One Dream, One Team". At the center of this strategy is an intention to deliver on our purpose to "Make Life Brilliant". The latter refers to making life brilliant for all stakeholders, shareholders, employees, partners, and communities. It is a purpose that is aligned to both De Beers and the government of Botswana's long-term ambitions. During 2021, the business continued to deliver on its strategic goals, while at the same ensuring the lives of our employees and communities are protected.

The two paths to value delivery at Debswana are optimisation in the short to medium term and reimagining of mining through Future Smart Connected Mines (FSCM) in the long term. The business continued to deliver on its key focus areas in 2022, journeying towards the achievement of our Big Hairy Audacious Goals (BHAG), people transformation, digital transformation and successful design and implementation of our future project, among others. Our optimization journey proved critical during the recent geopolitical and economic challenges (supply chain disruptions and inflationary pressures).

How is the diamond industry recovering post-pandemic?

The diamond industry's recovery has been positive, with 2022 starting strong and building on 2021's positive momentum.

Could you explain how do you note investment sentiment in diamond assets?

Diamonds remain strong as an option for investment. The continued prospecting activities and investments by industry players indicate the appetite and confidence for returns. The current trend of rare discoveries has also created great excitement in the market, leading to record value purchases. Furthermore, the industry is committed to ensuring that governance and ethics are upheld for both the sustainability as well as the global supply chain best practice aspects of the business. ■

Uranium

A potential African premium?

MAIN COUNTRIES:

- **Main producing countries**: Namibia, Niger
- **Emerging**: Malawi, Zambia, Mali

> *There has never been a case in history where the world has adopted nuclear to the extent it does now. I believe we are entering a new era for clean, reliable, nuclear energy, which bodes well for uranium producers.*
>
> ***Stephen G. Roman***
> ***President and CEO, Global Atomic***

From one of the most controversial – maybe even cussed - metals out there, uranium is rapidly gaining the desirable green recognition, as a favorable source of clean power. This switch from reprobation to acclamation comes from at least three realizations: The first is the urgency of phasing out fossil fuels; this is encouraging governments to consider nuclear power once again. The second is the collective acceptance that renewable alternatives are imperfect and insufficient to support the green transition; the shortcomings of solar or wind power, among which their intermittency coupled with incomplete battery supply chains, become the strengths of nuclear power. And this leads to the third driver for uranium, which is the acknowledgement that nuclear power has strong intrinsic advantages, advantages that have always been there but, without favorable external conditions, had been ignored. Not anymore.

France's President, Emmanuel Macron, was among the first to refer to nuclear power as "green" and call for a nuclear "renaissance" in the country. France's eagerness for nuclear is not so surprising given it already relies heavily on uranium for its energy needs, but there are other countries, among which the US and the UK, building nuclear reactors. This admission of nuclear power under the "green" label could not happen before enough time was left to mourn the tragedy of Fukushima. Today, Japan itself has two nuclear reactors underway, which is telling the world it is reasonable to think about the future. 53 is the total number of reactors built around the world as of May 2022, according to Statista.

This change in sentiment has been long coming for the uranium industry, including African players. Though Namibia and Niger, the two uranium-producing African countries, only account for 12% and 5% of global uranium production, the role of Africa in uranium supply cannot be understated: Outside of Kazakhstan, the global leader contributing to 46% of uranium production globally, Africa is the largest producer of uranium in the world, with a 17% share of the market from the two countries combined. Considering Kazakhstan's troubles to export uranium due to the sanctions applied to its neighbor, Russia, Africa's positioning becomes ever so critical in the uranium value chain.

Africa has a broad scope for increasing its footprint in uranium production, not only from its staple mines, including the Rössing mine in Namibia, or the Somair mine in Niger, but from greenfield projects that developers have been patiently investing in over the past few years. Canadian junior Global Atomic has started the construction at its Dasa Uranium Project in Niger. Dasa is believed to be the largest and highest-grade uranium deposit currently under development in the continent, with a mine life of 12 years just from the Phase 1 Mine Plan – which represents just 20% of the 250-million-pound (Mlb) deposit. Also in Niger, another advanced junior is GoviEx Uranium, which has recently published the DFS for its 100 Mlb (measured and indicated) Madaouela deposit. Both Madaouela and Dasa are expected to come into production in the next few years.

Namibia, on the other hand, has attracted more juniors since 2020 onwards, after the government lifted a 10-year moratorium on new license applications. Here, Australian junior Elevate Uranium was able to identify a 20 Mlb deposit at Koppies in just three years since acquiring the tenement in 2020. Madison Metals, a Canadian explorer and developer, recently bought a portfolio of exploration licenses in the proximity of Rössing and Husab mines, the largest in Namibia. Juniors are also carving their way into completely new uranium jurisdictions. GoviEx is advancing two other uranium projects in Zambia and Mali, respectively, while Lotus Resources, an ASX-listed junior, acquired in 2020 a brownfield uranium project in Malawi: "The Kayelekera mine operated between 2009 and 2014, producing about 11 million pounds (lbs) uranium over that period. What we liked most about this asset was that it was a past producer that delivered a high-quality product, which was accepted by all major Western conversion facilities," said Keith Bowes, managing director at Lotus Resources. However, it will be neither the size of African uranium deposits, nor the quality of the yellowcake (urania) that will ultimately allow developers to differentiate in the market, but how cleanly the metal is produced. To tap into the positive role that uranium plays in the green transition, producers may expect more scrutiny around their own energy sources. At an advantage will have those that already rely on clean grid power. In Malawi, for instance, Lotus Resources should be able to show its operation produces low CO_2 emissions because 80% of the grid power comes from renewables. In Niger, it will be down to each individual producer to invest in alternative, cleaner energy sources. GoviEx Uranium has, for the first time, included renewable infrastructure of 26% in its energy mix within the DFS. Asked whether uranium producers are subject to more scrutiny compared to producers of other metals, Daniel Major, the CEO of GoviEx Uranium said "That would be hard to argue, but I believe there is an increasing number of buyers within each commodity that pay attention to ESG. Of course, some people will buy gold regardless of where it comes from or how it was mined, and the same applies to uranium. For some offtakers, ESG is not part of their mandate, while others will demand a full site visit before even considering buying from you. The trend is towards greater scrutiny rather than less scrutiny for all commodities."

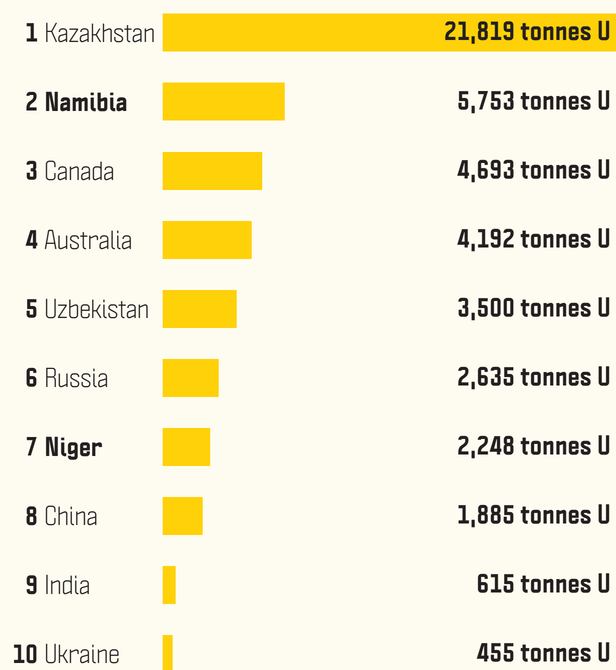
Besides attracting the new generation of ESG-driven investors, uranium may also open up to a group of investors rarely before interested in the metal – cryptocurrency investors. Bridging the gap between the crypto world and the uranium industry, Namibian explorer Madison Metals brings to the market the first uranium-backed NFT (non-fungible token) through a pioneering forward-sales agreement with Lux Partners. Duane Parnham, the executive chairman of Madison Metals, explained the roots of this idea: "Uranium has an unclear trading profile, comprised of short-term contracts between miners and end-users typically represented by utilities, trading houses, and governments. Such contracts are done in confidence, leaving little to the public domain, which results in a spot price that is not always reflecting the real price. Besides this disconnect, the average investor cannot access pure uranium play. Instead, retail investors can buy certificates into a basket, through Sprott Uranium Participation."

Through the five-year agreement with Lux, the Canadian junior receives capital from the tokens sold by Lux, while Lux introduces crypto investors to a stable NFT, backed by a tangible asset. This particular model works best for uranium because of the hazardous nature of the metal, which does not allow for traditional trading like for other commodities like gold or copper. This model is yet another example of the sophistication of the uranium mining industry, which inches closer to future-facing trends, including decarbonization and digital currencies. ■

> *Uranium is tied into the net-zero narrative, so it makes sense that uranium should be produced as cleanly as possible and with the best possible ESG profile. I can see two possible ways in which this could manifest: One can either end up with a premium for green metals, or those producing a dirty metal will see heavily discounted prices.*
>
> ***Keith Bowes***
> ***Managing Director, Lotus Resources***

TOP URANIUM PRODUCERS (2021)

Source:World Population Review



Murray Hill

CEO
ELEVATE URANIUM

Could you bring us up to date with the latest activity at the Koppies uranium project in Namibia?

Three years ago, we obtained the license for our Koppies tenement in the Namib Desert, so being able to say we identified a 20 million pounds uranium resource estimate within that three-year license term is an amazing outcome for Elevate Uranium. After raising A$11.5 million at the end of November 2021, we were able to intensify our exploration efforts, and we are now spending more than ever on an aggressive drilling campaign. As we speak, we have two drill rigs in operation, the first one focused on expanding Koppies and the other one at our Capri project. In the past 12 months, we grew our in-country team by six people (geologists and field assistants).

How is the uranium supply side prepared to respond to growing demand?

The supply side will only respond to a higher uranium price; the current uranium price is not high enough to cover costs for most projects. The approval and the development process for new projects are lengthy and it may be about four years or more to first uranium production. There are not enough projects to meet current nuclear reactor demand let alone to meet future growth. We are not racing to move into production: Our philosophy is to continuing exploring and build on our resource base. By the time the price is high enough, we should have four-five projects to choose from. We may see the uranium price increase to well above US$100/lb as nuclear facilities scramble for the available uranium.

Can you tell us more about what is like to be operating in Namibia?

New projects are likely to be developed in a shorter timeframe than other countries thanks to the existing history and culture of uranium mining. ■

Duane Parnham

EXECUTIVE CHAIRMAN AND CEO
MADISON METALS

Could you briefly introduce Madison Metals to our audience?

Madison Metals is an explorer and developer of uranium assets in Namibia. Our licenses are close to the country's two biggest uranium mines, Rössing and Husab. After Namibia lifted the 10-year moratorium on new applications in 2017, uranium projects were redistributed to entrepreneurs. We built a portfolio of exploration licenses with historical drilling as well as acquiring mining licenses that can allow us to fast-track production. The two project areas are called Madison North and Madison West, based on how they are positioned relative to Rössing. We also have about five exclusive prospecting licenses (EPLs) as part of a large and continuous land tenure.

What do you make of the current appetite for uranium?

The transition from hydrocarbons to green sources creates a large energy gap that uranium can fill. Nuclear energy has zero carbon emissions, low waste, a consistent base power, and is affordable; merits that have led France to recognize nuclear as "green." The world produces about 140 million lb/year and consumes 190 million lb, with the supply gap filled by stockpiles. Certainly, we will need to mine more uranium in the future, but a spot price of about US$49 is sub-economic for most mines.

What makes Madison Metals a good investment opportunity?

As the pioneers of the first uranium-backed NFT, we are bridging the uranium funding gap with the crypto world. The biggest opportunity for investors looking at Madison Metals is the amount of capital injected from Lux token sales on a non-diluted basis. We are projecting close to 20 million pounds at an average price of US$40/lb in the next 1.5 years. As a junior listed on the CSE and the OTCQB, we are not diluting our shareholders' interests. We are also one of the only juniors to have announced a share buyback program. Trading at about 14-15 million C$ market cap and with over 8 million C$ in cash, our share price is grossly undervalued. ■

Stephen G. Roman

PRESIDENT AND CEO
GLOBAL ATOMIC

Could you comment on the key milestones achieved over the last 12 months at the Dasa uranium project in Niger?

Today we have a fully staffed mining team together with the required mining equipment and our contractor, CMAC-Thyssen, at the site. We also held the opening blast ceremony to mark the beginning of the Dasa Phase 1 underground development to produce yellowcake for delivery to utilities in early 2025. Phase 1, or the "Flank Zone" mining area represents 20% of the 250-million-pound deposit.

In Q1 2023, we will publish our updated MRE, followed by a revised mine plan to reflect the higher resource later in 2023. The current drill program is indicating more resources will be converted into the Mineable Reserves category.

Our plan is for the mill to be ready at the end of 2024 and start shipping yellowcake in 2025.

As we complete more drilling and increase our Mineable Reserves through updated studies, our Phase 2 and potentially Phase 3, are expected to extend the Dasa operational life for many decades. The deposit remains open both on strike and down dip, as our recent exploration drilling has shown.

How has the context for uranium changed in 2022?

There has never been a time in history where the world has adopted nuclear to the extent it does now. I believe we are entering a new era for clean, reliable, nuclear energy, which bodes well for uranium producers. Uranium prices have moved higher from our FS (done at US$35) and term contracts are now in the US$50-60 range. The value of Dasa will continue to appreciate in a risinguranium market.

We delivered on all our milestones to date, despite difficult markets in the past, and we managed to keep share dilution to a minimum.

Dasa is the largest and highest grade uranium deposit currently under development in Africa, with a unique geological model. ■

Daniel Major

CEO
GOVIEX URANIUM

What are the highlights of the DFS for the Madaouela uranium project?

The DFS that came out in September 2022 confirms Madaouela to be one of the largest uranium resources in the world, with 100 million lb U3O8 in measured and indicated, as well as 20 million lb inferred. The project is self-sustaining and fully integrated, with an open pit mining area, a process plant, and two underground mines. We have 26% renewable infrastructure in our energy mix. Madaouela is a long-life project with a LOM of 19 years producing at a capacity of 2.6 million lb/y. CAPEX is estimated at US$343 million, but we continue to look at further optimizations like putting a PPA on the solar rather than capitalizing it.

What are the main updates at the Muntanga project in Zambia?

Muntanga is already mine permitted and we started working on updating the environmental permits to bring them to an IFC standard. We also started infill drilling on the main deposit and we are now focused on completing the FS by the first half of 2024. Mutanga is a simple, open-pit, heap-leach operation with very low acid consumption. It has also been very interesting to witness the political change in Zambia, the new government's approach to mining being very much pro-business in comparison to the previous leadership.

What are the advantages of advancing three projects in three jurisdictions at the same time?

GoviEx has created a pipeline of projects, with Madaouela in Niger, Muntanga in Zambia, and Falea in Mali, each advancing at different stages. At some point, most listed companies with a single asset will have to find a second asset to replace depleting resources. By doing this already, we get economies of scale and we offer our investors political diversification, which is particularly important in Africa. ■

Coal

What will come of African coal?

- **Main country**: South Africa
- **Other**: Mozambique, Botswana, Zimbabwe

Image courtesy of Jindal Africa.

Dirty, but dependable. Villainized, but not ostracized. This is the kind of contrary rhetoric that surrounded coal in 2022, after the use of this particularly loathed fossil fuel started to rise in replacement of Russian gas. South Africa's coal exports to the EU grew by more than five times between January and September. Described by Greenpeace as the "dirtiest, most polluting way of producing energy," coal and its many emissions became more pardonable than engaging with much grimier war politics. Of course, reverting to coal in a time of crisis like this cannot be read as more than a quick fix. The necessity of coal in 2022 will not change the general stance taken by governments ever since the Paris Agreement to phase it out, or how COP26 President Designate Alok Sharma put it, to "consign it to history." Since 2015, more than 75% of the planned coal plants were cancelled. However, coal is not yet a matter of the past; in fact, for countries like South Africa, it is still the reality of the present, with more than 80% of its energy being generated from locally sourced coal.

South Africa is the seventh largest producer of coal in the world, with about 250 million t of coal produced every year, of which about 75% is used domestically. But production has been declining. Under pressure from investors who have been shunning coal, large miners have divested or are currently divesting their coal assets. AngloAmerican recently completed the sale of its stake in Thungela, a thermal coal producer with seven mines in South Africa. South32, an Australian miner, also announced the sale of its South African thermal coal assets to Seriti Resources this year. These decisions are aligned with a global trend: Rio Tinto became coal-free in 2018. Vale divested from Mozambique in 2021. But the change in coal markets in 2022 planted second thoughts for some miners – BHP changed its mind about the sale of its Mt Arthur mine in New South Wales. According to some sources, BHP could not find a buyer, but other sources report higher coal prices made the mine attractive again.

"This has been the best year in the history of our Kiepersol anthracite mine," said Debratna Nag, the CEO of Jindal Mining, an Indian conglomerate with coal assets in South Africa and Mozambique. "We faced a very inflated price scenario as two of the biggest anthracite producers in the world (Russia and Ukraine) became locked in a war. Coal has been selling like hotcakes, not just in the domestic market but also in export markets, with record price increases," he explained, echoing an industry-wide sentiment.

Not everyone is walking away from coal. Australia and Indonesia, the fourth and fifth largest coal producers in the world, have been increasing production over the past two decades. Vuslat Bayoglu, managing director of South African private investment firm Menar, said: "While these countries recognized the humungous Asian appetite for growth and invested in coal, South Africa gradually decreased exports from 81 MT to 59 MT, leaving Richards Bay Coal Terminal's 91 MT capacity unfilled," he said.

While exports from South Africa to the EU surged this year, it is worth noting that exports to India, which is South Africa's largest export market, have actually decreased, even as India increased coal imports with shipments from Indonesia and even Russia, according to freight forwarding service Banchero Costa.

Interestingly, this year raised some doubts about the timing of the "end of coal." There are enough coal reserves in the world to last for another 100 years, but the timeline to exit coal expires in the next 10 to 30 years for most countries. The decision of Germany to boost its reliance on coal and the UK's approval a new coal mine in the northwest of England are showing that energy security can trump environmental concerns, at least in the short term.

So why should South Africa give up its coal soon, some may ask with indignation? Bayoglu explained the importance of coal to the South African economy, and what he sees as an unfair and unrealistic pressure to switch to renewables: "Coal represents the bread-and-butter of the local economy and one of the main employers in a country that is battling unemployment. A coal-reducing policy will be a huge bottleneck to the country's economic development as South Africa will deprive itself of its innate cheap energy source – a critical factor for power-intensive industries. South Africa is pressured to phase out coal, but if the same request was made to Saudi Arabia and its oil industry, it would never go down," he said.

"People always forget about coal, yet coal is the best performing commodity on stock exchanges right now and a lot of money is going into coal to minimize liability as the industry prepares for closure in the next five years."

Ralph Heath
Managing Director, Earth and Environment, WSP (Africa)

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Vuslat Bayoglu

MANAGING DIRECTOR
MENAR

A coal-reducing policy will be a huge bottleneck to the country's economic development as South Africa will deprive itself of its innate cheap energy source.

Could you introduce Menar to our international audience?

Menar is a private investment company with a mining-focused portfolio in different jurisdictions. In South Africa, we have assets in thermal coal, anthracite and manganese. In Kyrgyzstan, we are developing a gold asset. In Turkey, Menar owns a nickel-cobalt mine currently on care and maintenance. Two years ago, we started our first manganese project, marking a diversification towards other commodities. Currently, Menar's group of companies employ around 2,500 people across our operations. We are consistently looking for opportunities to grow our portfolio in a variety of minerals.

Could you elaborate on your South African coal and anthracite asset base?

On the coal side, we are mostly focused on thermal coal for exports, with three assets in operation. Khanye Colliery, in Bronkhorstspruit, produces 200,000 t/m run-of-mine coal at a 65% yield for 5,500 kcal/kg product, which is transported via rail and exported from Richards Bay Terminal to international markets. The Phalanndwa Colliery in the Delmas area runs at a capacity of 170,000 t/m, with 60% yield for RB3 product. Our third asset is in Piet Retief and is called Kangra. At Kangra we are mining 100,000 t/m high-quality coal to make RB2 and RB3 products. Besides our three producing mines, Menar is also investing in three development projects: Gugulethu, Bekezela and Thuso, all expected to enter production in 2023.

Amounting to a total investment of R600 million, Gugulethu will produce 200,000 t/m, mined from the surface for the first seven years, and then from underground. Bekezela, located in Springs, is our flagship project, with a huge capacity of 7.2 million t/y that will be sold into both the local and international markets, depending on logistics permissibility. Finally, Thuso, in Bethal, is going to be an underground mine where we plan to mine 1.2 million t/y of high-quality coal for RB1, which is mostly consumed by Europe.

On the anthracite side, we bought the underground Zululand Anthracite Coal (ZAC) from Rio Tinto in 2016, the only low-ash (-8%) anthracite produced in South Africa. ZAC also produces 17% ash product as middlings.

Two other anthracite projects have pending licenses. With this pipeline, Menar is positioned to become the largest anthracite producer in South Africa in the next two years. The South African coal industry has been constricted by logistics challenges as well as pressures to phase out coal from the energy mix.

How is the industry facing these challenges?

The war between Russia and Ukraine pushed coal prices to the benefit of the global coal industry. South Africa is a really great place for mining. Logistics-wise, Transnet is doing its best to move mining products to the ports. On the other hand, I believe Eskom is failing the country dismally. The utilities company is looking to invest in renewables in a country where coal represents the bread-and-butter of the local economy and it is one of the main employers in a country that is battling unemployment of up to 40% among young people. Even if South Africa receives the financial help to build renewables, this does not solve the issue of baseload, which can only be realized through coal, gas or nuclear. A coal-reducing policy will be a huge bottleneck to the country's economic development as South Africa will deprive itself of its innate cheap energy source – a critical factor for power-intensive downstream industries with a huge employment potential.

Could you elaborate on the opportunity in the manganese space?

In September 2020, Menar began opening the box-cut at the East Manganese open-cast mine.
Right now, we are mining a steady 30,000 t/m with 36.5% manganese content. This is a small project with only two years of life, but it is the perfect opportunity to learn manganese. Next year, we plan to publish a Feasibility Study.

What is your portfolio strategy in the future?

We are not shy about developing coal mines. In fact, we are proud that we create jobs and help secure the country's vital energy needs. At the same time, we are busy looking at other minerals, doing due diligence on manganese, chrome, and mineral sands, seeking to understand what is happening in different countries like Zambia, the DRC, Mozambique, Kenya, and Tanzania. Of course, we are focused on finding world-class projects of large scale and low-cost to make sure we will be competitive at any point in the commodity cycle. ■

The South African mining industry wants to be part of the new, green industrialization, rather than the old industrialization that coal sustained in the past. More than that, coal bears a negative image of unsafe, exploitative mining, nothing like the kind of sustainable mining that the industry is pursuing nowadays. Private companies with active coal mines like Menar are committing to high-standards of mining to dispel those negative associations – its fully-owned Canyon Coal wants to become a Bettercoal Producer, an international coal mining standard. At the same time, the South African player is also making sure to diversify its portfolio and has recently acquired its first manganese project. Exxaro Resources, the largest coal producer in South Africa, is heavily investing in renewables.

Lithium, manganese, copper, cobalt, and manganese are trending for investors, and, as more companies orient themselves to these future-facing elements, the coal industry is becoming increasingly consolidated. In South Africa, only a few producers supply Eskom, the utilities company. Exxaro Resources, which operates the largest mine in the country (Grootegeluk mine) and Seriti Resources operating the New Vaal mine are among the largest. In Mozambique, the parent company of Jindal has become the largest player in the country after both Rio Tinto and Vale pulled out. "Smaller companies are filling in the gap, so the coal industry is certainly not drying out because of that restructuring. The initiatives to phase out coal will take a long time, so in the short to medium term, coal is here to stay," commented Debratna Nag, the CEO of Jindal Mining.

The questions about the role of coal that have resurfaced in 2022 are likely to vanish almost as quickly as they started, but they do provide an opportunity to reflect on the readiness of the world to excuse the use of dirty coal in the face of an energy crisis. Perhaps a similar kind of understanding and tolerance could be applied to South Africa and its own unyielding energy crisis. ■

The global coal supply is restructuring itself, and volumes which used to go to the West are now going to the East, and the other way around.

Debratna Nag
CEO, Jindal Mining

Note: Debratna Nag has stepped down as CEO of Jindal Mining since conducting the interview with GBR in the summer of 2022

Services and Equipment

"Many premium ore bodies have already been exhausted, and thus technology is becoming more important than ever to access, extract and improve the viability of second-tier and third-tier deposits of lower grade and smaller size"

-Nigel Convey,
Senior Vice President (SVP) EMEA, Titanobel

Image courtesy of Tractafric.

Services, Equipment and Technology

A new generation of demand

Image courtesy of Rio Tinto

There are two main types of demand that concern the African servicing sector: The first is cyclical, tuned to the ups, downs, and in-betweens of commodity prices, but the second one is consistent – the need to optimize, reduce costs, and ultimately become more efficient, no matter if the industry is in a bear or bull market. So what happens when these demand forces overlap? In 2022, the imperatives of costs, decarbonization and sustainability coincided as soaring inflation and supply chain risks (both logistical and geopolitical) met with unparalleled interest in battery metals and energy efficiency. This conflation of factors is giving rise to a new generation of demand that affects almost every service and equipment supplier in the African market.

This new demand is characterized by a more acute need for costs savings, but, unlike in previous years, it is predilected on long-term cost savings. Moreover, demand for services and equipment is more influenced by ESG considerations. Africa has been known to lag behind other mining jurisdictions in terms of its adoption of renewables and lower-carbon technologies, but when the greener option is also the cheaper option, these become much more appealing. "Africa has been on the back foot of adopting technologies related to carbon emissions reduction, but this is beginning to change. We are seeing a new wave of demand for such technologies, like cleaner engines with reduced fuel consumption, and, I dare say, electrically powered mining equipment," said Paul Maes, sales management at Tractafric, a mining equipment dealer in Africa.

The entire supporting value chain of the mining industry is feeling the change, starting with energy suppliers, who are the most directly exposed to the double-faced demand of cleaner-plus-cheaper power. For the recently launched power division of Vivo Energy, West Africa is a sweet-spot because many mines operate off-grid and use 100% HFO or diesel – both fuels more expensive in 2022. For Vivo Energy's customers, the CO2 savings come as a bonus.

As both corporations and governments are starting to think long-term about energy security and energy costs, more sophisticated, technology-led energy solutions providers come into the mix. Energy Exemplar, an analytics organization that provides software for energy market modelling and simulation to 485 clients in 70 countries, among which the South African utilities company, Eskom, experienced a 30% growth in 2022. The increased complexity of the energy sector, driven by everything from technological advancements to supply chain challenges like the banning of Russian gas in Europe, but also the unpredictability of weather events caused by climate change, has created a greater need for understanding the right energy pathway for the future using data and software, said David Wilson, the CEO of Energy Exemplar. For instance, an energy market operator can run 25,000 scenarios using historic weather data to prepare an outlook for adverse weather events, he explained: "A decade or so ago, there were only a few assets, mostly big thermal assets, in the energy system, which were easy to predict, but managing risk and uncertainty in a much more complex environment with significantly more assets spread all over the network has become more intricate," Wilson said.

Consultancies and engineering firms are also playing a bigger role in supporting the mining industry with ESG issues. Zn Geo Services, a geological and environmental consultancy established in 2015 in South Africa, offers two types of environmental services – compliance-based and non-compliance, though the former is the most popular among its customers, since the mining industry is not yet willing to pay for the nice-to-haves. These unregulated nice-to-haves, like novel tailings solutions, remain stuck in a push-and-pull dynamic. Through its MissionZero technologies, FLSmidth, an engineering and equipment supplier in mineral processing, could theoretically see a mine use up to 80% less energy. Deon De Kock, the president of FLSmidth for Sub-Saharan Africa, Middle East and South Asia, said it is easier to push the MissionZero agenda by arguing higher productivity and energy efficiency, but less so for environmental solutions like dry stack tailings. "The cost-value proposition is not convincing enough as yet, however, societal pressures, investors, and government regulations are pushing the industry towards ESG," he said.

"The difference in this cycle is the central theme of sustainability and ESG that accompanies capital investment. This includes a shift towards decarbonisation and greener technologies, as evident by the growth of the EV market in some parts of the world."

Nishen Hariparsad
General Manager (Technology, Innovation, Global Product Management and Marketing), BME

African governments are becoming more aware of the need to create a fair balance of interests between the state and investors. Local populations are also demanding better transparency not just from their governments, but also from corporations.

Mouhamed Kebe
Managing Partner, Geni & Kebe

Regulatory developments across Africa are creating stricter frameworks for service providers. In the DRC, all labs are required to obtain ISO accreditation. Meanwhile, South Africa amended its Environmental Impact Assessment (EIA) Regulations, tightening the loop on who can perform these assessments and cutting out unregulated players from the mix, said Zama Sithole, managing director at ZN Geo Services: "A new regulatory body has been instilled to oversee the competency of environmentalists, which means it will not be sufficient for a provider to only possess an environmental qualification to perform EIAs. EAPs will need to be registered with EAPASA and the board will certify whether one is eligible to compile and review EIAs. The new law tightens the loop and ensures that only competent providers get to conduct these assessments. From a competition perspective, the law cuts unregulated players from the mix. As a compliant, registered, and adequately qualified service provider, ZN Geo Services is competitively positioned under the new framework."

The pull factor – or what compels the mining industry to adopt technology – is also a lack of skilled personnel that can be replaced by technology. German plant engineering company Loesche opened its first-of-its-kind sales department focused solely on its digital solutions package in South Africa, where it found a skills gap for operations, maintenance and engineering. The choice of the location was certainly not coincidental. Because of skills deficits, efficiency gains from software solutions are far greater in so-called developing countries than first-world countries, said Christian Gerhard, managing director at Loesche South Africa. The vertical roller mill (VRM) supplier saw just a 5% mill improvement in Turkey, but 22% in Indonesia. In South Africa, Loesche expects similarly high results. "The main challenge is mindset resistance more than anything else. Mining and processing haven't changed much in the last 100 years. Everyone is comfortable with the old ball mill and wet technology, while the concept of VRM is quite foreign. Our technology is a dry process, it uses little water, and is air-swept, enabling substantial water and energy savings. In general, our VRMs use 45% of the typical conventional mill system," said Gerhard.

To respond to the new requirements of the African mining sector, service, equipment and technology suppliers have transformed themselves. Inflation and supply chain challenges have affected them in-as-much or more than it did their customers, so they had to step up their optimization. This has led to a de-commoditization of the offer through better planning and better management of resources and the greater use of technology. For example, blasting company Titanobel developed digital technologies like electronic detonators to optimize the use of ammonium nitrate. According to Nigel Convey, senior VP at Titanobel EMEA, pneumatically loaded ammonium nitrate led to up to 15% waste in the past, but this method has become increasingly rare today. "Given the global challenges, ammonium nitrate can no longer be treated as a commodity, and Dyno Nobel has the technologies available to increase the efficiency of blasting, reduce costs and limit the environmental impact associated with wastage," Convey said.

The pressures on raw materials availability, including natural gas used to make ammonia and ammonium nitrate, have been a key driver of efficiencies within the services sector, especially when high demand met with supply challenges. A similar dynamic impacted the logistics sector, particularly in the Copperbelt, where copper exports have been growing rampantly over the last few years, putting pressure on the availability of trucks and creating huge queues at borders. Logistics companies like Bolloré, a leader in the market, are increasing their truck fleets. Competitor Polytra Fracht found a solution in reusing the trucks importing sulfur into the country to export copper. Amaury Luyckx, head of Africa at Polytra Fracht, explains the idea: "We realized that one solution is to have better control over the import side of the cargo, which is dominated by sulfur: 1 t of copper consumes about 800 kg of sulfur, so the import of sulfur is almost at parity with the export of copper concentrate."

With the right tools, the entire mining value chain can be optimized. There is no single solution, but a balance of probabilities. Future weather impact, future technology, and future regulations are all explored in our simulations.

David Wilson
CEO, Energy Exemplar

Reflecting back on his two decades' long career in Africa, Samad Osman, the COO of logistics company OMA Group, told GBR: "The biggest challenge facing senior managers in logistics is to change the fate of something that went wrong, in an industry where something will go wrong in 19 out of 20 shipments."

Technology can be of great help to anticipate, reduce, and manage these risks: "OMA Group has just launched a new in-house-developed system to control the risks of handling any shipment in Africa. Through it, we can present our clients with a digital dashboard that accounts for risks and potential price increases. Customers often fear that the final costs may be higher than initially estimated due to unforeseeable challenges. The new system is currently being piloted in Ghana and it will be rolled out to Ivory Coast and then cascaded into francophone West Africa. We are also striving towards excellence by taking greater control of the cargo. We improved our refill time from 4-5 days to 1-2 days and shortened cargo clearing from 14 days to 5 days."

Besides controlling internal costs in order to keep prices attractive for their clients, service and equipment companies are also working on their ESG credentials, and some are aggressively targeting this new kind of green-sustainable and cost-sustainable demand. Engineering company FLSmidth decided to not participate in any greenfield coal projects. Meanwhile, PwC is committing to become net zero by 2030, to make sure it is leading by example, as Richard Ansong, partner at PwC Ghana put it. Global logistics provider DHL is also making progress towards its 2050 net-zero emissions, having decarbonized this year 100% of its LCL (less than container load) by consolidating ocean freight and using sustainable marine fuel. For FCLs (full container load), the same offer is used on an optional basis. 'Green logistics' are becoming an attractive option for the mining industry when reporting their Scope 3 emissions (or the emissions associated with the broader supply chain). The company is also offering offsetting options under "GoGreen." These consist of assessing the amount of CO_2 emissions associated with a shipment and committing to offset them through tree planting, detailed Serigne Ndanck Mbaye, the CEO West Africa & country head Ghana at DHL Global Forwarding.

Greener energy is a priority in the quest to reduce carbon emissions. Vivo Energy has launched a power division in 2020 and closed its first contract with miner Robex Resources in Mali to install a solar battery solution. For its long-standing business as a retailer of fuels and lubricants, Vivo Energy brought to the market low (50 ppm) sulfur fuels in West Africa and has found ways to reduce the number of transportation trucks by half. Commenting on these developments, Alex Caldwell, head of mining at Vivo Energy, said "We want to be seen less as a commodity supplier and more as a partner in value improvement projects. In the background, we are busy implementing new technologies like Shell Remote Sense, fitting equipment with remote sensors and creating an onboard system to tell users when to change the oil – this results in astronomical savings. With such technologies, we reduce fuel consumption, creating loyalty in return." ■

What have been the main trends and developments of 2022?

ENGINEERING

"The global commodities boom of the last two years has attracted many new investors to mining. Non-mining companies are also showing interest to branch out into mining without any experience or know-how. However, there are just not enough experienced technical people in the local industry. The shortage of personnel is an opportunity for consultancies because of our competitive rates compared to hiring high-level expertise. Nevertheless, the skills shortage is of concern to the industry at large."

Sodhie Naicker, Managing Director of DMT Kai Batla (South Africa)

LOGISTICS

"Our customers seek consolidation solutions from different suppliers to reduce logistics costs. Acquisitions outside of Ghana are also on the rise, with majors like Endeavour creating a broad regional presence in West Africa. This creates an opportunity for Ghana to become a services hub and we are supporting the creation of free zones and bonded warehouses in Ghana, the first free zone operated by DHL is live in Takoradi already to complement our bonded warehouse in Tema."

Serigne Ndanck Mbaye, CEO West Africa & Country Head Ghana, DHL Global Forwarding

SOFTWARE

"The market has been good up until very recently, when inflation and reactionary interest rates started to roar their heads. As a result, the mining industry has contracted. This contraction will be spilling over to service providers, though there is a little bit of a lag time. From the explorer reducing the number of drill rigs to the lab operator analysing fewer samples, a slow market catches up with everyone. As many surveys have found, the mining industry pays lip service to data management, without putting it into practice. There's an hesitancy around taking risks, based on the thinking that, if something works, why change it."

Viv Preston, Director, maxgeo

LEGAL

"Most of our work is with the government and the mining association. Artisanal miners are a concern to the industry because of the dramatic damages they inflict on the environment, and the conflicts that may rise between clandestine miners and their formal counterparts at industrial mining sites. To mitigate these risks, the government must engage with the social equation and seek to develop projects that have a real social, economic and educational impact on communities. Right now, a Committee of Local Development is overseeing social projects."

Kouamé Klemet-N'Guessan, KSK Avocats

HR

"Our client portfolio grew by 20% year-on-year on the back of new mines starting production and requesting our services. Mining companies represent the biggest share (about 80%) of our client base today. Mali remains our strongest market with the biggest growth opportunities moving forward. Recruitment in the mining sector is on the rise with more jobs coming onstream and a very active labor market, hence the high growth our industry is experiencing no."

Diadie Sankare, President, SAER-EMPLOI

Consolidations in the services space in 2022

TITANOBEL WAS ACQUIRED BY INCITEC PIVOT

"We completed the acquisition at the end of April 2022, incorporating Titanobel within Dyno Nobel Asia Pacific, a division of Incitec Pivot Limited (IPL). Historically, Titanobel's customer base has mostly been in the quarries and civil construction sectors, while Dyno Nobel Asia Pacific predominantly services mining clients. Titanobel's footprint is centred on France and Africa, regions where Dyno Nobel did not have an operating presence. With the acquisition, we are now well- placed to tap into a prolific mining region combining Titanobel's well-established brand and footprint with Dyno Nobel's mining know-how and technologies."

Nigel Convey, Senior Vice President (SVP) EMEA, Titanobel

FLSMIDTH ACQUIRED THE MINING BUSINESS OF THYSSENKRUPP, TK MINING

"With the acquisition, FLS gained access to the technologies that will enable us to serve the value chain from pit to plant, whether it is in-pit crushing and conveying or replacing electric trucks, as well as to assist with technologies like high-pressure grinding rolls (HPGRs) and acentric roll crushers. To become a pure-play mineral processing company, our core portfolio will be concentrated on technologies and digital solutions for sustainable mining."

Deon De Kock, President, Sub-Saharan Africa, Middle East & South Asia, FLSmidth

VITOL BOUGHT VIVO ENERGY

"Building on our legacy as a Shell distributor of fuels and lubricants, we are leveraging the newly created synergies with Vitol, especially from a fuel perspective. We have introduced to the market fuels with low sulfur content that offer significant savings by improving the performance, efficiency and longevity of equipment and engines in the mining sector. These 50 ppm fuels are now introduced on a much broader scale, specifically into Senegal and Mali, but also the rest of West Africa, where we are market leaders."

Alex Caldwell, Head of Mining, Vivo Energy

MSC ACQUIRED BOLLORÉ AFRICA LOGISTICS

"Bolloré Africa Logistics will remain an independent entity that will keep its organisation and its headquarters in Puteaux. A new brand name will be unveiled in 2023."

Dolores Biamou, Mining Director Africa, Bolloré Logistics

A big thank you to our contributors this year!

- AAMEG
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- African Mining Services
- AfriTin Mining
- AIM (Alternative Investment Market)
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